

Beyond One-Size-Fits-All: The Power of Personalized MOOCs in Transforming Business Higher Education in Morocco

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Abstract— The integration of Massive Open Online Courses (MOOCs) into higher education curricula offers substantial opportunities for creating personalized learning environments. As educational institutions increasingly adopt these online platforms, personalized learning pathways (PLPs) have emerged as a prominent trend. The aim of this research is to evaluate how the integration of PLPs through MOOCs affects student learning engagement and academic performance. By focusing on a specific cohort, this study seeks to provide insights into the effectiveness of personalized education strategies in Moroccan business higher education contexts. A sample of 86 Moroccan students are selected using stratified random sampling technique to ensure representation across various demographics within the student population. The theoretical framework is based on a mixed-methods research approach. Qualitative data highlight some recurring themes, including increased autonomy in learning, tailored content that meets individual needs, and enhanced interaction with peers and instructors. While quantitative data reveal significant correlations between the implementation of PLPs through MOOCs and enhanced learning engagement as well as improved academic success among participants. Furthermore, students who engaged with personalized recommendations based on their career endeavors were more likely to complete courses and engage in more than one course compared to those who did not choose a career-related course. Nonetheless, there was a discrepancy between the level of engagement and type of MOOCs selected by different students. The findings contribute valuable knowledge regarding personalized education frameworks, offering practical recommendations for educators and policymakers in Morocco and beyond. Furthermore, it may inform future developments in MOOC design and implementation strategies that prioritize personalization in business higher education.

Keywords— Business students, Higher education, Morocco, Mixed-methods research, MOOCs, Personalized learning pathways (PLPs)

V. BACKGROUND

The integration of Personalized Learning Pathways (PLPs) through Massive Open Online Courses (MOOCs) has garnered considerable attention in recent years, particularly in the context of higher education. The growing emphasis on personalized learning strategies, supported by the flexibility of MOOCs, has made it crucial to evaluate their impact on student learning engagement and academic performance. This

literature review synthesizes existing research on PLPs, MOOCs, and the role of personalized education in enhancing student engagement and performance, with a specific focus on Moroccan business higher education contexts.

A. Definition and Characteristics of PLPs

At their core, PLPs are designed to give students the freedom to choose how, when, and what they learn based on their individual needs and preferences. PLPs enable learners to select their learning routes, whether it be through varying levels of difficulty, diverse content formats, or specific subject areas (Lokey-Vega, Jorrín-Abellán, & Pourreau, 2014). For example, in a PLP model, a student might choose to explore a particular topic in-depth if they have a strong interest in it, while another student may opt for a different focus based on their professional aspirations or prior knowledge. This choice allows learners to experience education as something personally relevant rather than something imposed externally.

The flexibility in PLPs also extends to pacing. Students can work at a speed that suits their learning style, whether they prefer to advance quickly through familiar content or take more time to master challenging topics. Such pacing is particularly important in higher education settings, where learners come from diverse backgrounds and bring varying levels of prior knowledge and experience to the table. As Dziuban et al. (2017) note, this ability to learn at an individualized pace contributes to a deeper engagement with the material, as students can move through content that feels relevant and manageable for them.

B. Personalized Learning Pathways (PLPs) in Higher Education

Personalized Learning Pathways (PLPs) have become a growing trend in higher education as institutions seek to create learning environments that respond to the unique needs and preferences of individual students. These pathways use adaptive technologies and data-driven strategies to tailor learning materials, teaching methods, and assessment processes to fit each student's specific requirements (Anderson et al., 2025). As a result, PLPs can significantly boost student motivation and engagement by delivering learning experiences that are both relevant and context-specific (Dziuban et al., 2017).

Designed to accommodate each student's pace, preferences, and learning style, PLPs offer a highly personalized educational experience. As Lokey-Vega, et al. (2014) points out, these pathways give students the freedom to choose their learning routes, allowing them to align their educational journey with their interests, learning styles, and prior knowledge. This flexibility empowers students to take control of their learning, progressing in ways that best suit their abilities and goals. Research has shown that PLPs foster greater motivation, enhance learning outcomes, and encourage deeper engagement with course material (Dziuban et al., 2017). When students can personalize their learning, they tend to develop stronger critical thinking and problem-solving skills, ultimately improving their academic performance (Bates, 2015). PLPs are more than just a passing trend; they represent a transformative approach to education that can have a lasting impact on student success in today's diverse academic settings.

C. Impact on Academic Performance and Learning Outcomes

Research has consistently shown that personalized learning pathways (PLPs) lead to improved academic performance and better learning outcomes. By customizing the learning experience to meet each student's unique needs, PLPs enable deeper understanding and mastery of the course material. Bates (2015) points out that these pathways encourage active learning, critical thinking, and problem-solving—key skills for success in fields like business education, where applying concepts to real-world scenarios is essential. This type of engagement helps students develop higher-order thinking skills, which are crucial for both academic success and professional growth.

Additionally, the personalized nature of PLPs allows students to build on their prior knowledge, reinforcing concepts they already understand while providing support in areas where they may struggle. This continuous, iterative learning process leads to better retention and mastery of material. Dziuban et al. (2017) found that students in personalized learning environments often perform better than those in traditional classrooms, as they are able to engage with the content at their own pace and in ways that suit their learning style. By addressing individual strengths and weaknesses, PLPs also help students develop critical academic skills such as independent research, problem-solving, and analytical thinking—abilities that are not only important for academic success but also for professional achievement.

D. Fostering Deeper Engagement with Course Material

One of the significant benefits of PLPs is their ability to foster deeper engagement with course material. Dziuban et al. (2017) argue that true engagement in learning is not just about how much time is spent on the material, but the quality of interaction between the learner and the content. PLPs enhance this engagement by allowing students to personalize their learning experiences, ensuring they interact with the material in ways that are both challenging and stimulating. This approach promotes active, meaningful learning rather than passive memorization.

Moreover, the flexibility of PLPs gives students the autonomy to pursue their academic interests with greater independence. In higher education, many students aim to acquire knowledge that directly aligns with their career goals. By allowing them to explore topics in depth and from various perspectives, PLPs bridge the gap between theoretical learning and real-world application. This personalized approach helps students not only retain the information more effectively but also apply it in practical settings, leading to improved academic performance and long-term success.

E. MOOCs as a Vehicle for Personalized Learning

Massive Open Online Courses (MOOCs) have fundamentally changed the way education is delivered, offering flexible and scalable learning opportunities to students worldwide. One of the key benefits of MOOCs is the flexibility they offer, allowing learners to study at their own pace and from any location. While early critiques of MOOCs focused on issues such as high dropout rates and limited student engagement (Jordan, 2013), recent innovations, especially in AI-driven adaptive learning technologies, have paved the way for the integration of Personalized Learning Pathways (PLPs). This shift has greatly enhanced the learning experience by making it more structured and interactive, providing students with a tailored educational journey (Khalil, et al., 2022). This flexibility not only gives students greater control over their learning paths but also plays a significant role in advancing personalized education. Personalized MOOCs now offer customized course recommendations, adaptive quizzes, and individualized feedback, helping to address the unique learning needs of each student (Kizilcec et al., 2020).

With a range of instructional methods, including videos, interactive exercises, and online discussions, MOOCs cater to various learning styles, making education more inclusive and adaptable to individual needs (Anderson & Whitelock, 2014). In addition, Personalized Learning Pathways (PLPs) have emerged, offering customized course recommendations, adaptive quizzes, and individualized feedback tailored to each learner's needs (Khalil et al., 2021; Kizilcec et al., 2020). These innovations allow students to engage with content that matches their learning preferences, progress at their own pace, and receive real-time support. By overcoming geographical, financial, and institutional barriers, MOOCs have made high-quality education more accessible, scalable, and adaptable, providing a powerful platform for personalized learning on a global scale. As a result, MOOCs now offer not only flexibility but also a dynamic, individualized approach to education that enhances engagement and improves retention.

F. Academic Performance and Personalized Education

Academic performance, traditionally measured by grades, has long been understood to correlate with the quality of a student's engagement with coursework. Personalized education strategies, which tailor learning experiences to individual needs, have increasingly been recognized for their positive impact on students' academic outcomes. By accommodating diverse learning preferences and allowing students to progress at their own pace, personalized learning fosters a deeper understanding of complex concepts. Research by Bower et al. (2017) supports this, finding that students in personalized learning environments demonstrated improved

retention and performance, particularly in STEM fields, as a result of the adaptability of learning resources to their unique needs. This adaptability ensures that students can revisit challenging material, reinforce understanding, and engage more deeply with the content, thereby improving academic performance.

While the connection between personalized learning and academic performance is well-established, there is a gap in research specific to business education. Recent studies, however, have begun to explore how these personalized approaches can benefit students in business disciplines. Mulder, et al. (2006) highlight that personalized learning pathways (PLPs) not only enhance academic achievement but also foster critical thinking and problem-solving abilities—skills essential to success in business education. The flexibility and self-paced nature of PLPs, especially within MOOCs, allow business students to delve deeper into specialized areas, facilitating a richer understanding and more practical application of business concepts. Additionally, Zamiri and Esmaeili (2024) argue that personalized learning in business education helps students connect theoretical knowledge with real-world scenarios, further enhancing their ability to apply what they have learned in dynamic, professional contexts. These studies suggest that personalized learning strategies can significantly enrich business education by nurturing both academic performance and key professional skills.

G. Contextualizing the Research: Moroccan Higher Education and Business Education

In the context of Moroccan higher education, the integration of Personalized Learning Pathways (PLPs) through MOOCs offers promising opportunities to enhance student learning experiences. The Moroccan higher education system faces significant challenges, including limited resources, large class sizes, and a predominantly teacher-centered approach to instruction (Houssami, 2024). These issues often hinder the ability to provide individualized attention and tailored learning experiences. By adopting personalized education strategies facilitated by MOOCs, there is potential to address some of these challenges. MOOCs offer flexible, adaptive, and student-centered learning environments that enable learners to engage with content at their own pace, revisit challenging material, and explore topics of personal interest. This adaptability not only helps to overcome resource constraints but also empowers students to take more control over their educational journeys, potentially leading to improved academic outcomes and greater satisfaction with their learning experiences.

Business education in Morocco, while rapidly evolving, continues to grapple with outdated teaching methods and a lack of personalization in course delivery (Krichene, 2020). In this context, MOOCs present a valuable solution for bridging the gap between traditional pedagogical methods and the evolving demands of business education. MOOCs offer Moroccan business students access to a wealth of global knowledge, customized learning experiences, and the opportunity to develop critical business skills that are aligned with international standards. Preliminary studies have indicated that Moroccan students are generally receptive to MOOCs, appreciating the flexibility and diversity of content these platforms provide (Razouki et al., 2017). However, while the potential of MOOCs in enhancing business

education is recognized, more research is needed to explore how the integration of PLPs in MOOCs specifically impacts student engagement and academic performance in the Moroccan context. Such research could provide valuable insights into how personalized learning strategies can be effectively implemented to improve the quality of education and better prepare Moroccan students for the global business landscape.

H. The Moroccan Business Higher Education Context

Higher education in Morocco is currently undergoing a significant digital transformation, marked by the increasing adoption of online learning and digital pedagogical strategies. This shift is particularly important in business education, where institutions face persistent challenges related to student engagement, course completion rates, and the alignment of curricula with the evolving demands of the job market (El Ferouali, & Ouhadi, 2023). As business students increasingly seek education that aligns with real-world skills, the integration of Personalized Learning Pathways (PLPs) within MOOCs offers a promising solution. By providing more tailored, competency-based learning pathways, PLPs enable students to focus on the specific skills and knowledge they need, improving their engagement with the content and enhancing their preparedness for the workforce. These personalized, adaptive learning experiences can help address the issues of low course completion rates and disengagement, as they allow students to progress at their own pace and according to their individual learning needs.

While the potential benefits of online learning in Morocco are clear, prior research emphasizes the importance of adopting localized strategies to maximize the effectiveness of digital education (El Ferouali & Ouhadi, 2023). The unique cultural, linguistic, and educational contexts of Morocco require digital education solutions that are tailored to the needs of local students and the challenges they face. Localized approaches can ensure that MOOCs and PLPs resonate with Moroccan learners and support their academic and professional goals. For instance, incorporating relevant local business contexts, offering multilingual content, and ensuring that online platforms are accessible to a broad range of students are all critical factors that can enhance the effectiveness of digital education in Morocco. Therefore, while the integration of PLPs within MOOCs holds significant promise for business education in Morocco, further research is needed to explore how these technologies can be best adapted to meet the specific needs of Moroccan students and improve their educational outcomes.

Conclusion and Gaps in the Literature

While existing research consistently highlights the positive impact of Personalized Learning Pathways (PLPs) and MOOCs on student engagement, retention, and academic performance, a significant gap remains in understanding how these models function within the context of Moroccan higher education, particularly in business education. Much of the existing literature has been focused on developed countries, where educational systems often have more resources and established online learning infrastructures. In contrast, regions like Morocco, which face distinct challenges such as large class sizes, resource constraints, and a teacher-centered approach to learning, have received relatively little attention

in this area. This lack of research is notable, especially considering the potential for PLPs and MOOCs to address some of these very challenges by offering more flexible, adaptive, and student-centered learning opportunities.

This gap in the literature underscores the urgent need for more targeted studies that explore the application of these educational models within emerging economies like Morocco. Given the unique challenges and opportunities present in such contexts, it is crucial to understand how personalized learning can be effectively implemented to improve educational outcomes. In particular, the integration of PLPs within MOOCs could offer Moroccan business students the flexibility and tailored learning experiences necessary to enhance both engagement and academic performance. The present study aims to fill this gap by specifically evaluating the integration of PLPs in MOOCs within a Moroccan business school. By focusing on this cohort, the research will provide valuable empirical evidence on the effectiveness of personalized learning strategies in this unique educational setting. In doing so, it will contribute to a broader understanding of how digital education models can be adapted to meet the needs of students in emerging economies and offer practical insights for enhancing business education in Morocco.

VI. RESEARCH METHODOLOGY

A. Research Design

This study adopts a mixed-methods research design (Creswell, & Plano Clark, 2018), combining both quantitative and qualitative approaches to gain a well-rounded understanding of how Personalized Learning Pathways (PLPs) in MOOCs affect student engagement and academic performance. A quasi-experimental design is used, with two groups: an experimental group that interacts with MOOCs featuring PLPs, and a control group that takes traditional MOOCs without any personalization.

To ensure robust and reliable findings, the study utilizes a pre-test and post-test design. Baseline data on student engagement and academic performance is collected before the intervention begins, while post-test measures is taken after the MOOC courses are completed to assess changes in these areas. This longitudinal approach helps analyze how PLPs influence learning progression over time. Additionally, the study incorporates a triangulation strategy by combining survey data, learning analytics, and qualitative insights from interviews and focus groups, providing a comprehensive evaluation of PLP effectiveness while minimizing potential biases from relying on a single data source.

B. Sample and Context

The study recruits Pre-Master students enrolled in a Business English and Communication course at a Moroccan Business higher education institution. Participants are selected using purposive sampling, based on course enrollment to ensure a diverse mix of academic backgrounds, learning preferences, and levels of digital proficiency. The sample includes students from various specializations within the business faculty, providing a well-rounded view of how Personalized Learning Pathways (PLPs) impact different areas of study.

A minimum sample size of 86 students is targeted to ensure statistical reliability and the ability to detect significant differences between the control and experimental groups. To minimize selection bias, participants are randomly assigned to either the control or experimental group, ensuring an even distribution of factors like prior academic performance, technological skills, and motivation levels. Additionally, demographic and prior learning data are collected to address potential confounding variables, ensuring the findings are robust and applicable to the impact of PLPs in MOOCs on student engagement and academic performance in the context of Moroccan business education.

C. Data Collection Methods

- Surveys and Questionnaires – To measure students' engagement levels, learning experiences, and perceptions of the effectiveness of PLPs within MOOCs, a structured survey is administered at both the beginning and end of the course. The survey incorporates Likert-scale items, open-ended questions, and demographic variables, ensuring a comprehensive assessment of students' attitudes and experiences. This approach provides both quantitative and qualitative data on how students interact with PLPs and their overall learning journey.

- Academic Performance Metrics – To assess the impact of PLPs on academic performance, course completion rates, assessment scores, and participation records is collected from the MOOC platform. These metrics are analyzed to gauge how PLPs influence students' academic outcomes. Specifically, pre- and post-course assessment scores are compared to determine any changes in learning outcomes and to evaluate the effectiveness of personalized learning pathways in improving academic performance.

- Interviews and Focus Groups – In addition to quantitative data, semi-structured interviews with selected students and instructors are conducted to gather qualitative insights into their experiences and perceptions of PLP integration. Focus groups are also organized to foster discussions about learning challenges, student motivations, and the perceived benefits of PLP integration. These discussions offer a deeper understanding of the subjective experiences of both learners and educators within the personalized learning environment.

- Learning Analytics – Detailed data on student behavior within the MOOC platform are extracted, including time spent on learning tasks, engagement with discussion forums, frequency of accessing personalized content, and trends in quiz performance. These analytics provide valuable insights into how students interact with PLPs over time, revealing patterns of engagement, content utilization, and areas where learners may need additional support or motivation. This data are instrumental in evaluating how students adapt to personalized learning strategies throughout the course.

D. Data Analysis

- Quantitative Data – Statistical analysis are used to examine the impact of PLP integration on student engagement and academic performance. Descriptive statistics are used to identify key trends and patterns across different student demographics, such as variations in student engagement, academic performance based on the type of MOOC selected or the learning progression. These statistical summaries not

only offer insights into overall effectiveness but also highlight disparities or areas requiring further attention, thereby guiding informed decisions for educators and policymakers in enhancing personalized learning strategies.

- Qualitative Data – Thematic analysis are conducted on interview and focus group transcripts to uncover key themes and patterns related to student learning experiences. Through systematic coding and theme development, the analysis highlights critical aspects such as the value of tailored feedback, increased learner autonomy, the perceived relevance of course material, and student satisfaction and motivation. It also reveals challenges faced by students, including difficulties with self-regulation or inconsistencies in MOOC quality. By capturing the depth and nuance of individual experiences, thematic analysis complements the quantitative findings and helps paint a holistic picture of the impact of PLP integration on student engagement and academic success. These insights inform the refinement of educational strategies, ensuring they are responsive to the actual needs and preferences of learners.

E. Ethical Considerations

This study strictly adheres to ethical research guidelines to ensure the protection of participants' rights and privacy. First and foremost, informed consent is obtained from all participants, ensuring they understand the purpose of the research, the nature of their involvement, and their right to withdraw at any time without penalty. Participation in the study is completely voluntary, and participants are given clear information about how their data will be used and how it will contribute to the study. Confidentiality has been maintained throughout the research process, with all personal identifying information kept anonymous and stored securely.

Furthermore, the study ensures data security by adhering to research-standard protocols for handling and storing data, minimizing the risk of unauthorized access. Before data collection begins, formal approval has been obtained from both the students and the school's administration, who have reviewed the study's design to ensure it meets all necessary ethical standards. This approval process helps guarantee that the study upholds ethical practices and protects the well-being of all participants. By adhering to these ethical considerations, the research strives to maintain integrity, transparency, and respect for participants throughout the entire study.

VII. RESULTS

A. Quantitative Data

a) Student Engagement

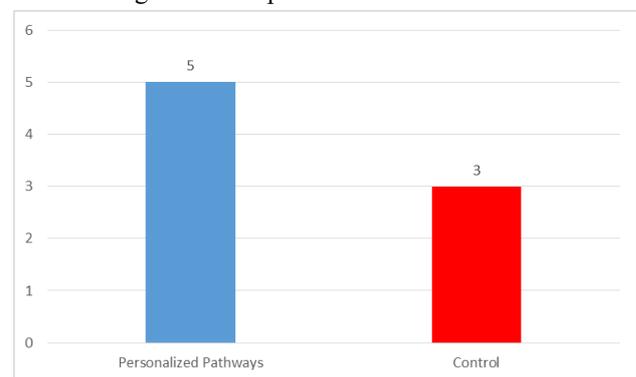
Student engagement in online learning platforms is a crucial metric for evaluating the effectiveness of educational strategies, such as the implementation of Personalized Learning Pathways (PLPs). By examining specific engagement metrics, we can assess how personalized learning impacts student involvement and their overall experience with the platform.

- Time Spent on Platform –

One of the primary indicators of student engagement is the time spent on the learning platform. For students following personalized learning pathways, the average time spent per

week on the platform is 5 hours. In comparison, the control group, which uses a traditional, non-personalized learning model, spends an average of 3 hours per week. This represents a 60% increase in time spent by students in the personalized pathway group. This increase in time suggests that personalized learning pathways lead to greater student interest and a more immersive learning experience, because the content is more relevant and tailored to the students' individual needs and preferences.

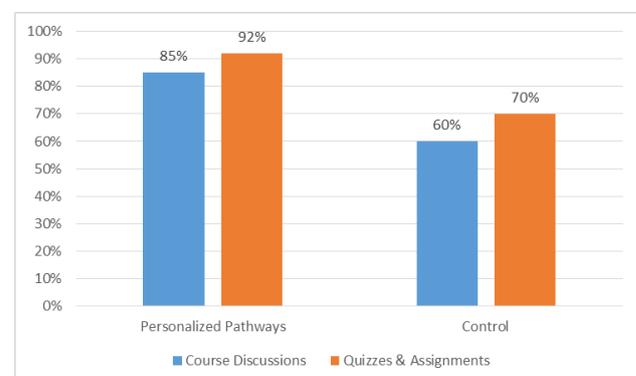
Fig. 1: Time Spent on Platform in hours



- Active Participation (Discussions, Quizzes, Activities)–

Active participation is a critical aspect of engagement, as it directly reflects how students are interacting with the course material. In terms of discussions, Fig. 1 demonstrates that 85% of students who followed personalized pathways engaged in course discussions after the first module. In contrast, only 60% of students in the control group participated in discussions at the same point in the course. The data indicates that personalized pathways significantly boost participation, likely because students feel more connected to the material and are motivated to engage with peers and instructors.

Fig. 2: Frequency of Active Participation by group



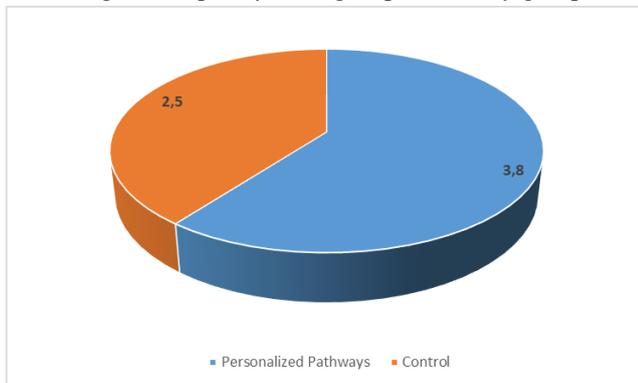
Further, Fig. 2 shows indicates that 92% of personalized pathway students completed quizzes and assignments, compared to only 70% of students in the control group. This

higher completion rate for personalized pathway students could be a result of the adaptive nature of these pathways, where the content is better aligned with students' learning preferences, making assignments feel more manageable and relevant to their goals.

- Logins per Week -

Another important metric is the frequency of logins, which indicates how often students interact with the learning platform. On average, Fig. 3 demonstrates that students following personalized learning pathways logged in 3.8 times per week, whereas the control group averaged only 2.5 logins per week. This represents a 52% increase in logins for students on personalized pathways. The more frequent logins suggest that students are motivated to regularly engage with the course, possibly due to the personalized nature of the content and the ongoing, dynamic feedback they receive, which encourages continued participation and learning.

Fig. 3: Frequency of Logins per week by group

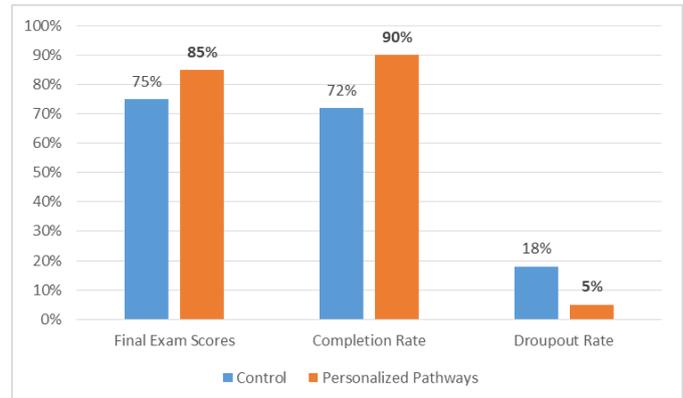


In summary, the data reveals that students in personalized learning pathways are more engaged across multiple metrics: they spend more time on the platform, participate more actively in discussions and assignments, and log in more frequently. This suggests that personalized learning strategies foster higher levels of engagement, likely because they align more closely with the individual needs, interests, and progress of students, making the learning experience more relevant and compelling.

b) Student Academic Performance

Academic performance is a critical outcome when evaluating the effectiveness of personalized learning pathways (PLPs). By analyzing specific performance metrics such as final exam scores, completion rates, and course grades, we can gauge how personalized learning impacts student achievement and retention (see Fig. 4).

Fig. 4: Frequency of Student Academic Performance by group



- Final Exam Scores -

One of the most straightforward measures of academic performance is the score achieved on final exams. For students who followed personalized learning pathways, the average final exam score was 85%, compared to 75% for students in the control group. This 13.3% improvement in exam scores for personalized pathway students indicates that the tailored nature of the learning experience likely helped students retain and understand the material better. Personalized pathways offer customized content that addresses students' individual strengths and weaknesses, which could contribute to improved exam performance by reinforcing key concepts at the right pace (see Fig. 5).

- Completion Rate -

Completion rate is an important indicator of how many students finish the course, reflecting both their level of engagement and their ability to stay motivated throughout the duration of the course. For students in personalized learning pathways, the completion rate was 90%, significantly higher than the control group's 72%. This 18% increase in completion rate suggests that personalized pathways contribute to higher levels of motivation and persistence. When students experience a more tailored learning journey that suits their learning pace and needs, they are more likely to remain committed to completing the course (see Fig. 5).

Moreover, the dropout rate for personalized pathway students was just 5%, compared to 18% for students in the control group. This dramatic difference in dropout rates further reinforces the idea that personalized learning pathways support students in staying engaged and completing their courses. By providing a more adaptive and relevant learning experience, personalized pathways may help reduce feelings of frustration or disengagement, which can often lead to dropping out (see Fig. 5).

Fig. 5: Percentage of Student Academic Performance by Group

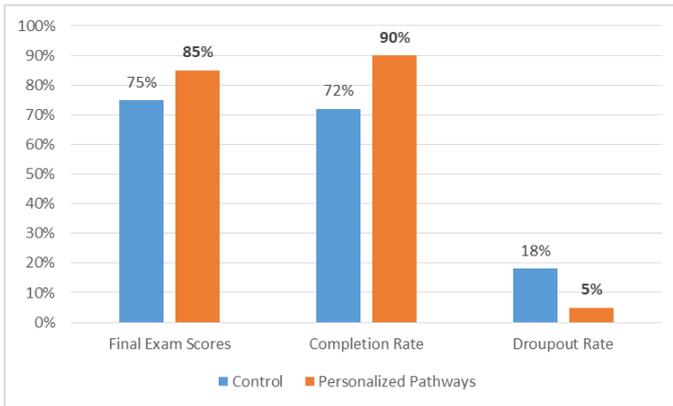
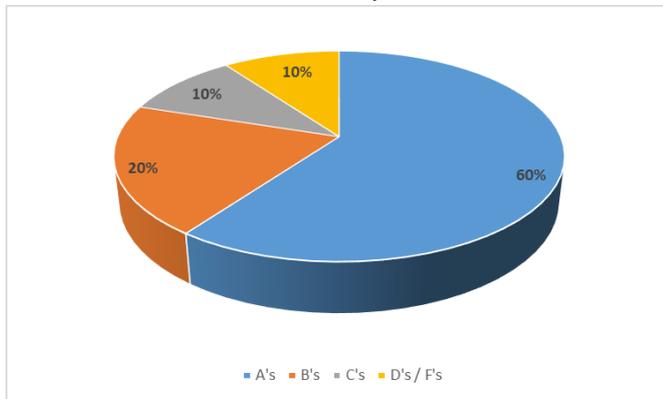


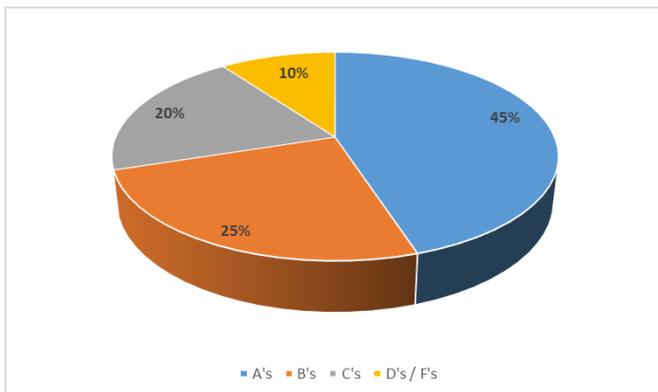
Fig. 6: Grade Distribution in MOOCs for Personalized Pathways



In comparison, the control group had the following grade distribution (see Fig. 7):

- 45% received A's
- 25% received B's
- 20% received C's
- 10% received D's or F's

Fig. 7: Grade Distribution in MOOCs for Control Group



- Course Grades-

The distribution of course grades provides a more detailed picture of overall academic performance across different levels of achievement. Among personalized pathway students, the grade distribution was as follows (see Fig. 6):

- 60% received A's
- 20% received B's
- 10% received C's
- 10% received D's or F's

The higher percentage of A's (60% compared to 45%) among personalized pathway students indicates that not only are they more likely to complete the course, but they are also achieving better results overall. The personalized learning experience allows for deeper engagement with the content, which may contribute to stronger academic outcomes. Additionally, the smaller percentage of D's/F's in the personalized pathway group (10% compared to 10%) suggests that personalized learning pathways help reduce the number of students struggling significantly with the course material.

The data reveals that students who followed personalized learning pathways consistently outperform their peers in traditional learning models across various academic metrics. Personalized pathways led to higher final exam scores, better completion rates, and improved grade distributions. These improvements can be attributed to the tailored nature of personalized learning, which adapts to students' individual needs and learning paces. By offering a more supportive and engaging learning environment, personalized pathways increase motivation, reduce dropout rates, and ultimately result in better academic performance. This underscores the effectiveness of personalized learning strategies in promoting student success in higher education.

c) Learning Progression

Learning progression is a crucial metric to evaluate how effectively students are advancing through course content, the pace at which they are learning, and how personalized pathways may impact their learning speed and ability to stay on track. This metric provides insights into the efficiency and adaptability of the learning environment.

- Progress Tracking-

The ability to track student progress over time is fundamental to understanding how well personalized learning pathways are working. The data reveals that 40% of students following the fast-track personalized pathway completed the course in 3 weeks or less, compared to only 15% in the control group (see Fig. 8). This significant difference suggests that the personalized pathways, which allow students to move through material at their own pace and skip over content they already understand, enable faster progression for students who are ready to advance quickly.

Fig. 8: Frequency of Course Completion in 3 weeks or less

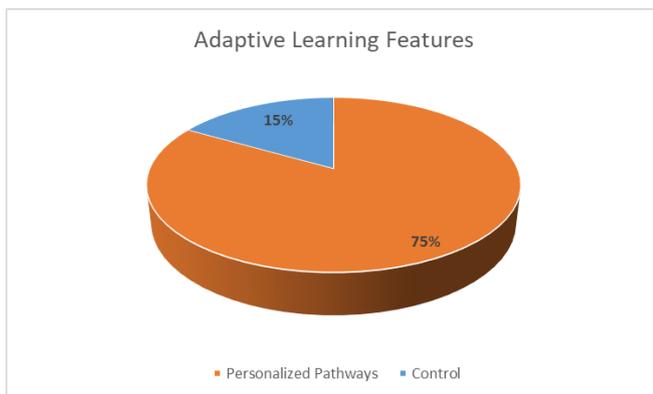


This finding highlights the flexibility of personalized pathways, allowing motivated or more advanced learners to complete the course more efficiently without being held back by traditional, one-size-fits-all pacing. By offering a fast-track option that aligns with individual learning speeds, personalized learning pathways cater to a wide range of learners, accommodating both those who need extra time and those who prefer to move more quickly through the content.

- Adaptive Learning Features-

Adaptive learning features play a critical role in tracking and supporting student progress by tailoring the learning experience to each individual's needs. The data shows that 75% of students in personalized learning pathways utilized adaptive learning features (see Fig. 9). This high percentage reflects how integral adaptive learning tools are to the personalized learning experience. Adaptive learning technologies monitor students' progress in real-time, adjusting content delivery to address areas where students are struggling or providing more advanced material if they are excelling.

Fig. 9: Frequency of utilization of Adaptive Learning Features



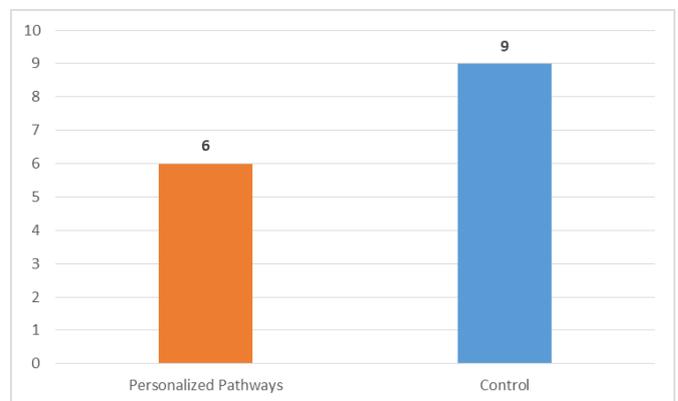
By continuously adjusting the difficulty level and providing real-time feedback, adaptive learning features create a dynamic learning environment where students are more likely to stay engaged and progress effectively. The widespread use of these features indicates that personalized pathways not only provide a more individualized learning

experience but also actively support students' learning in a way that fosters their academic growth.

- Time to Completion-

Time to completion is another essential metric to evaluate the overall efficiency of personalized learning pathways. The average time to completion for students in personalized learning pathways was 6 weeks, compared to 9 weeks for students in the control group (see Fig. 10). This 3-week difference suggests that personalized learning pathways are more efficient at helping students complete the course in less time. The ability to progress at their own pace, with content adjusted to their individual needs, likely reduces time spent on material that they already understand and directs their attention to areas where they need more focus.

Fig. 10: Average Weeks to Course Completion



The reduced time to completion in the personalized pathway group can also be attributed to the optimized learning process, where students are not held back by a fixed schedule or pace dictated by the course. Instead, they can progress quickly through content that aligns with their prior knowledge, leading to faster learning and a more efficient educational experience overall.

The data on learning progression suggests that personalized learning pathways significantly improve how students move through course material. The ability to track progress and adapt content in real-time allows students to engage with the material at a pace that suits their individual needs, leading to faster completion rates.

- 40% of students in the fast-track personalized pathway finished the course in 3 weeks or less, which was significantly higher than the control group at 15%.
- 75% of students utilized adaptive learning features, reflecting the effectiveness of these tools in fostering student progress.
- The average time to completion for personalized pathway students was 6 weeks, 3 weeks faster than the control group's 9 weeks.

Overall, the findings in this study illustrate that personalized learning pathways not only help students complete courses faster but also optimize their learning by using adaptive technologies that cater to individual needs.

This results in more efficient and effective learning, especially for students who benefit from a flexible, customized educational experience.

B. Qualitative Data

Qualitative data provides rich, detailed insights into the students' personal experiences, perspectives, and feelings about their learning journey. In this case, feedback from both personalized pathway students and control group students provides valuable information about the effectiveness and limitations of different learning approaches, particularly in terms of student engagement.

- Student Feedback on Engagement-

Personalized learning pathways, which tailor the learning experience to the individual needs and pace of students, received predominantly positive feedback from the students who participated in them. These students appreciated the flexibility, targeted support, and the opportunity to engage with content in a way that was more relevant to their individual learning needs.

"The personalized pathway helped me focus on topics I needed more time on, while skipping what I already knew."

This feedback underscores a key benefit of personalized pathways: the ability to engage with content that is relevant to the student's current level of understanding. For students who already possess knowledge in certain areas, skipping repetitive content ensures they don't waste time on material they have already mastered, which can increase motivation and overall engagement with the course.

"I felt more motivated because the content was directly aligned with my goals and interests."

Students reported feeling more motivated when the learning experience was personalized to match their personal goals and interests. This statement suggests that personalized pathways are not only adaptive in terms of difficulty but also in terms of relevance, creating a more engaging learning environment.

"I liked how the platform adapted to my learning pace and how I could revisit tough topics."

Here, the student emphasizes the flexibility of the platform to adjust to their learning pace, a feature of personalized learning pathways. The ability to revisit difficult concepts and review content at their own pace seems to have enhanced their engagement, as they felt empowered to control their learning journey. This aligns with research showing that self-paced learning can lead to deeper engagement and better retention.

"Having learning recommendations based on my performance made me more confident in my ability to succeed."

This feedback illustrates how personalized pathways can improve student confidence. When the platform adjusts to the student's progress and suggests learning resources based on their performance, it not only provides support but also fosters a sense of self-efficacy. Students who feel confident in their ability to succeed are more likely to engage fully with the course material.

The qualitative data gathered from students provides valuable insights into their experiences with personalized and traditional learning pathways. Students following personalized learning pathways consistently highlighted how the flexibility and adaptability of the platform positively impacted their engagement. These students appreciated the ability to focus on areas where they needed additional help while bypassing content they had already mastered. This aligns with existing research that suggests learners are more motivated and engaged when they feel the material is relevant and aligned with their own needs (Anderson et al., 2020). Additionally, the opportunity to revisit difficult concepts at their own pace seemed to foster a sense of control over their learning, contributing to higher levels of confidence and overall academic performance.

Overall, the qualitative data paints a clear picture of the benefits of personalized learning pathways in increasing student engagement and motivation. Personalized pathways allow students to tailor their learning experiences to their individual needs, which helps them stay engaged, feel confident, and perform better academically. In contrast, the traditional learning pathway presents challenges related to pace, relevance, and content alignment, which can lead to disengagement and diminished motivation. This feedback further supports the growing body of evidence advocating for the adoption of personalized learning approaches to enhance student learning experiences.

- Instructor Feedback on Personalized Pathways-

Instructor feedback is crucial for understanding the broader impact of personalized learning pathways on teaching and learning. It offers insights into how instructors perceive the effects of personalized pathways on student engagement, participation, and academic progress. This feedback not only highlights the benefits of adaptive learning technologies but also illustrates the challenges faced by instructors in traditional, non-personalized learning environments.

Instructors teaching courses with personalized learning pathways, which often incorporate adaptive learning technologies, reported several positive outcomes, particularly in student engagement, participation, and the ability to address the diverse needs of learners.

"The adaptive features allowed me to focus on students who were struggling, while also challenging those who were excelling."

This comment highlights a major advantage of personalized learning pathways. Adaptive technologies allow instructors to differentiate their teaching strategies by targeting specific student needs. For students struggling with certain concepts, instructors can provide additional support and resources. Conversely, for students who are excelling, adaptive features can present more challenging material, allowing instructors to push these students further. This individualized attention enhances the overall learning experience and ensures that all students are appropriately challenged and supported.

"I noticed more frequent participation and deeper insights in discussions when students had personalized recommendations."

Instructors observed that students who received personalized recommendations based on their performance were more actively engaged in discussions. This likely reflects the way personalized pathways help students feel more connected to the material, as the content is more relevant and tailored to their current level of understanding. When students are provided with content that matches their learning needs and interests, they tend to engage more deeply, contributing more meaningful insights to class discussions. This feedback underscores how personalization can foster a more dynamic and interactive classroom environment.

"Student engagement increased significantly, particularly in modules where adaptive feedback was provided."

Adaptive feedback is an essential component of personalized learning pathways, as it provides students with timely, specific information about their progress. Instructors noted that student engagement increased in modules where adaptive feedback was incorporated. This suggests that when students receive immediate feedback on their performance, they are more likely to stay motivated, make adjustments to their learning strategies, and remain engaged in the course material. The combination of personalized content and real-time feedback appears to create an environment that promotes active learning and sustained engagement.

The feedback provided by instructors who have experience teaching both personalized and traditional courses offers valuable insight into the practical benefits and challenges of each approach. In personalized learning environments, instructors highlighted how adaptive learning technologies enabled them to deliver targeted support to struggling students while simultaneously encouraging high-performing students to excel further. This differentiated approach creates a balance between support and challenge—an essential factor in maintaining student engagement and promoting meaningful learning outcomes.

Moreover, the positive effects of personalized learning pathways on student participation and engagement were consistently noted. With access to personalized recommendations, students felt more motivated to contribute to discussions and share deeper insights—likely because the content resonated more closely with their individual needs and academic goals. In addition, real-time adaptive feedback played a crucial role in sustaining engagement by equipping students with tools to actively monitor their progress and refine their learning strategies as needed.

In contrast, instructors teaching traditional, non-personalized courses reported facing greater difficulties. These courses, which lack flexibility and adaptability, often led to higher dropout rates, as many students struggled to stay engaged or find relevance in the standardized content. Engagement levels were generally lower, primarily because students were unable to tailor their learning experiences to their preferences or pace. This contrast reinforces the idea that one-size-fits-all models often fail to address the diverse learning styles and motivations of students, leading to disengagement and, at times, attrition.

Ultimately, instructor feedback sheds critical light on the impact of personalized learning on both teaching effectiveness and student outcomes. Instructors in personalized settings

observed notable improvements in engagement, participation, and motivation—largely due to the adaptive features and individualized content. Meanwhile, those in traditional settings faced ongoing challenges with student retention and participation. Taken together, this feedback strongly supports the integration of personalized learning pathways as a more effective strategy for meeting diverse student needs and improving educational success in contemporary learning environments

- Student Satisfaction and Motivation-

Student satisfaction and motivation are critical factors in assessing the effectiveness of educational methods, particularly when comparing personalized learning pathways to traditional, one-size-fits-all approaches. By understanding students' perceptions of their learning experiences, institutions can better evaluate the impact of personalized learning strategies on academic engagement and success.

- Personalized Pathway Students-

Students following personalized learning pathways generally report higher satisfaction and motivation compared to those in traditional courses. This is primarily due to the adaptive and individualized nature of personalized learning, which tailors content, pace, and support to each student's unique needs. The feedback from students in this group highlights several key aspects of their positive experiences:

"I felt more in control of my learning journey, and that made me feel more confident."

One of the most frequently cited benefits of personalized learning is the sense of control it gives students over their educational journey. Students in personalized pathways appreciate being able to set their own pace, revisit challenging topics, and focus on areas where they need more help. This autonomy fosters a greater sense of ownership and agency in their learning process, which, in turn, boosts confidence. When students feel in control of their learning, they are more likely to engage deeply with the material and persist in their studies, even when challenges arise.

"Personalized learning felt like I was getting a one-on-one experience, even in a large course."

A key feature of personalized learning pathways is their ability to replicate a more individualized learning experience, even in large courses. While students might feel lost or overlooked in traditional, one-size-fits-all environments, personalized pathways provide content and support tailored to each student's pace and learning style. This individualized attention—whether through adaptive learning technologies or personalized feedback—creates the illusion of a one-on-one experience, which is highly valued by students. The feeling of being seen and understood as learners contributes significantly to their satisfaction and motivation.

"The course felt more relevant to my career goals because of how the content was tailored."

Another reason for the increased satisfaction among personalized pathway students is the perceived relevance of the course content to their personal and career goals. By tailoring learning to students' interests, strengths, and aspirations, personalized pathways allow students to engage

with material that is directly aligned with their future ambitions. This relevance not only boosts motivation but also makes the learning process more meaningful. Students are more likely to stay engaged and committed when they see the direct connection between their studies and their career or life goals.

The contrast in student satisfaction and motivation between the personalized pathway group and the control group underscores the impact of personalization on the overall learning experience. Students in personalized pathways feel more in control, confident, and motivated, which are essential factors for academic success. The ability to adapt the learning experience to individual needs and preferences leads to a deeper sense of relevance, engagement, and ownership. By tailoring the content to students' interests and career goals, personalized learning pathways foster a sense of purpose in students' academic journeys. This relevance boosts students' motivation, as they are more likely to invest time and effort into coursework that aligns with their personal or professional aspirations. Furthermore, the perception of receiving personalized attention, even in large courses, strengthens students' sense of connection to the learning process, increasing their engagement and satisfaction. On the other hand, students in the control group often experience frustration and disengagement due to the lack of flexibility and customization in traditional courses. Struggling with the pace of the course or feeling that the material is too generic leads to a drop in motivation, which can ultimately affect learning outcomes. These students may feel disconnected from the material, leading to lower levels of engagement, participation, and retention. Overall, the feedback from both groups emphasizes the significant role personalized learning pathways play in enhancing student satisfaction and motivation. By providing a tailored, adaptive learning experience, personalized pathways ensure that students feel supported, challenged, and motivated throughout their educational journey. This contributes not only to a positive learning experience but also to better academic outcomes, as motivated students are more likely to succeed in their studies.

- Challenges and Barriers-

While both personalized learning pathways and traditional courses offer distinct advantages, they each come with unique challenges and barriers that can impact the students' experiences and overall satisfaction. These challenges often stem from the limitations of the technologies and pedagogical approaches involved, as well as the individual preferences and learning habits of students. Understanding these barriers is crucial for refining educational strategies to make learning more effective and accessible for all students.

"Sometimes the adaptive learning tools didn't fully understand my learning preferences."

One of the key components of personalized learning is the use of adaptive learning technologies that adjust content based on student performance and preferences. However, some students in the personalized pathway group reported that the tools didn't always align perfectly with their learning needs. Adaptive systems rely on algorithms to determine the best path for a student, but these algorithms are not always able to account for every nuance of a student's learning style. This can lead to frustration if students feel that the system isn't offering

the most effective learning strategies for them. For example, a student who might prefer more visual or hands-on learning experiences may find the system primarily offering text-based content or quizzes, which may not be the best fit. This issue highlights the need for continuous refinement of adaptive systems to better account for the complexity of human learning preferences.

"It was easy to get distracted since the platform kept offering different paths."

Although personalized pathways are designed to give students flexibility, this very flexibility can sometimes become overwhelming. The ability to choose different learning paths or modules can result in students feeling uncertain about which direction to take, leading to distraction or indecision. With so many options available, students may struggle to stay focused and might feel a lack of direction in their learning journey. This challenge reflects the paradox of choice—while offering multiple pathways is beneficial in theory, it can cause students to become indecisive or disengaged if not carefully managed. To address this, it's essential for platforms to provide clear guidance or structure while still allowing flexibility in how content is explored.

The challenges and barriers identified by both personalized pathway and control group students highlight the different ways in which learning environments can either support or hinder students' educational experiences. For personalized pathway students, the limitations of adaptive learning technologies, while still in development, can create frustrations if the system doesn't fully capture their learning needs. This can undermine the very benefits that personalized learning is meant to provide. Additionally, the flexibility inherent in personalized pathways, which is intended to enhance engagement, can become a source of distraction if not carefully managed. Students may struggle to navigate too many options or feel overwhelmed by the multitude of possible learning paths. This reveals a need for balance in the design of personalized learning systems—flexibility should be offered, but with sufficient structure and guidance to help students stay focused and motivated. On the other hand, students in traditional courses often face challenges due to a lack of personalization and flexibility.

Without the ability to adjust the pace of learning or engage with content that aligns with their individual preferences, students may quickly become disengaged, frustrated, or even feel lost. In particular, standardized assessments and rigid course structures often fail to accommodate the diverse needs of learners, which can lead to decreased motivation and lower academic performance. These limitations highlight the growing need for more personalized and flexible learning environments. That said, it is important to recognize that both personalized pathways and traditional courses come with their own sets of challenges. Personalized learning systems, while offering notable advantages in terms of engagement, motivation, and outcomes, still require ongoing development to refine their adaptive capabilities and better support each student's unique learning journey. Conversely, traditional courses stand to gain from incorporating more adaptive features—such as tailored feedback and flexible pacing—which could significantly boost student satisfaction and success.

By acknowledging the limitations and strengths of both approaches, educational institutions can move toward designing more inclusive and effective learning experiences. Ultimately, the goal is to provide all learners with the tools, support, and flexibility they need to thrive in increasingly diverse educational settings.

- *Summary Insights* -

Quantitative: The personalized learning pathways through MOOCs led to significant improvements in student engagement, including higher time spent on the platform, more frequent logins, and increased participation in discussions. Students in personalized pathways performed better academically, with higher completion rates and final exam scores compared to the control group.

Qualitative: Student feedback highlighted that personalized learning pathways made the experience more relevant, motivating, and tailored to individual needs. Instructors also observed higher engagement and better learning outcomes. However, some students expressed frustration with adaptive systems that didn't fully align with their learning preferences, while others in the control group felt disconnected due to the lack of personalization.

C. MOOCs Data

In exploring the impact of MOOCs (Massive Open Online Courses) on student engagement and academic performance, both quantitative and qualitative data provide a well-rounded understanding of how different types of courses and the frequency of completing them influence student outcomes. These two data types work together to offer deeper insights into student behaviors, attitudes, and learning experiences, which are essential for understanding the effectiveness of MOOCs.

a) *Quantitative Data*

Types of MOOCs: Quantitative data can help categorize the types of MOOCs students engage with and measure the outcomes associated with each type. MOOCs can be classified into several categories, including:

Technical MOOCs: These include courses focused on subjects such as programming, data science, engineering, and other technical fields. Typically, these courses involve practical assessments like coding assignments, quizzes, and projects that assess technical skills.

Humanities and Social Sciences MOOCs: These courses may cover topics like history, philosophy, literature, or psychology. The assessments are often more essay-based or involve participation in discussions, emphasizing critical thinking and the ability to engage with theoretical content.

Professional Development MOOCs: These are courses aimed at improving career skills, such as leadership, project management, or specific industry-related knowledge. These MOOCs often provide certifications that may be valued by employers.

By tracking the completion rates of students in each of these categories, we can identify whether certain types of courses are more engaging or if students in technical fields

tend to complete their courses more frequently compared to those in the humanities or professional development categories. Quantitative data can also capture student performance metrics, such as quiz scores, assignment grades, and overall course grades. This helps measure whether students in one type of MOOC perform better or worse than those in another.

Frequency of Completing MOOCs: The frequency with which students complete MOOCs is another key variable that can be explored using quantitative data. For instance:

Single vs. Multiple Course Enrollment: Some students may prefer to take one MOOC at a time, dedicating focused attention to mastering the material, while others may take multiple courses simultaneously, balancing different learning demands. Quantitative data on course enrollment frequency can help identify which approach leads to higher completion rates and better performance outcomes.

Completion Rates Over Time: Tracking how many courses a student completes over a certain period can shed light on engagement patterns. Are students who have completed multiple MOOCs over the past year more likely to perform better, or do they show higher rates of course re-engagement? This data helps understand whether repeated participation in MOOCs leads to improved learning outcomes, such as increased mastery of course material or enhanced retention.

By collecting these quantitative metrics, researchers can also calculate average course completion rates across different demographics (e.g., age, gender, location), offering insights into whether certain groups are more likely to complete MOOCs than others. For instance, we might find that younger students or those from urban areas tend to enroll in and complete more courses compared to older or rural students.

b) *Qualitative Data*

Types of MOOCs: While quantitative data offers measurable outcomes, qualitative data provides deeper insights into the personal experiences and perceptions of students, helping us understand the reasons behind their engagement and performance. For example:

Technical MOOCs: Students might share their experiences about the difficulty level of the content, the clarity of instructional videos, or the hands-on learning components. Do they feel motivated by real-world applications, or do they struggle with the technical challenges? Students might also reflect on the usefulness of interactive tools, such as coding simulators or practice platforms.

Humanities and Social Sciences MOOCs: Students' feedback could reveal how they engage with readings, discussions, and assignments. Do they feel that the course content aligns with their interests? Are the discussion forums stimulating? By providing open-ended responses, students might explain whether they felt connected to the course material or found the assessments to be meaningful.

Professional Development MOOCs: Qualitative responses may provide insights into how students perceive the practical value of the course content. Are they able to apply the skills learned in the course to their careers? How do they feel about

the course format? Is the certification valuable in their professional lives?

The qualitative data helps us understand how students from different fields view their MOOCs and whether the type of course impacts their engagement and perceptions of value.

Frequency of Completing MOOCs: The qualitative perspective on how often students complete MOOCs is essential for understanding their motivations and challenges. For instance:

Motivations for Frequent Completion: Some students may express that they take MOOCs regularly because they enjoy the flexibility of learning on their own time, while others might take courses to advance their career. Students might describe how completing more MOOCs helps them stay competitive or gain specific skills for their professional growth. This feedback complements the quantitative data showing whether frequent enrollment leads to higher completion rates.

Barriers to Completion: Students may also discuss the reasons why they struggle to complete MOOCs. These could include time constraints, lack of motivation, or difficulty with the course material. By analyzing these qualitative responses, we can uncover deeper factors that explain why some students fail to complete MOOCs despite initial engagement. This might also explain the lower completion rates for certain types of MOOCs or among certain student demographics.

i. Integrating Quantitative and Qualitative Data

When combined, quantitative and qualitative data offer a more comprehensive understanding of how MOOCs impact student learning. For example, quantitative data on completion rates and performance scores can be complemented by qualitative insights about why certain courses lead to higher levels of engagement or why students from different backgrounds experience varying levels of success.

Engagement Patterns: Students who complete technical MOOCs more frequently may report that they enjoy the hands-on, problem-solving nature of the content. In contrast, students who take fewer professional development MOOCs may explain that they don't find the certifications valuable enough to complete them. The combination of both data types helps identify trends in course preference and performance.

Barriers to Success: Quantitative data might show that rural students have lower completion rates, but qualitative feedback can explain why—perhaps due to access issues, internet connectivity, or language barriers. This context allows educators and administrators to develop more targeted interventions.

In conclusion, using both quantitative and qualitative data to assess different types of MOOCs and students' frequency of completion provides a rich, nuanced understanding of how MOOCs impact learning outcomes. The numbers tell us *what* is happening, while the qualitative insights help us understand *why* it is happening, enabling educators and course designers to create more effective, engaging learning experiences.

c) Quantitative Data: List and Type of MOOCs Courses Used by Business Students

The quantitative data collected from business students reveals a diverse set of MOOCs that cater to different aspects of business education, including management, marketing, finance, entrepreneurship, and business analytics. The data also reflects the frequency of course enrollment and completion.

Business Management and Leadership MOOCs:

The data on students' use of Business Management and Leadership MOOCs offers valuable insights into both participation and completion patterns, providing a clear view of how business students engage with online learning in these critical areas. Here's a detailed breakdown of the data:

Course Examples:

Strategic Management: This course likely covers the key aspects of business strategy, such as analyzing industry trends, formulating long-term goals, and understanding competitive advantages. It's essential for students who aspire to higher leadership roles.

Leadership in Organizations: This course focuses on leadership styles, team management, organizational culture, and effective decision-making. It's particularly important for students pursuing managerial positions, as strong leadership is a fundamental skill in any business environment.

Organizational Behavior: This course addresses the psychological and behavioral aspects of working within organizations, including motivation, group dynamics, communication, and conflict resolution. It is crucial for students who will manage teams or work closely in collaborative environments.

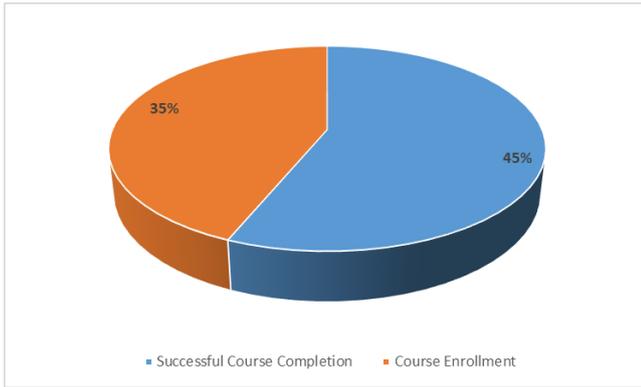
Change Management: Focusing on how organizations can successfully implement and navigate changes, this course is key for students who aim to be change agents within organizations, especially in fast-paced or evolving industries.

Frequency of Participation:

45% of business students enrolled in management-related courses: This indicates that nearly half of the business student population is seeking additional education in management and leadership, which highlights the importance of these skills in the business world. The relatively high enrollment suggests that business students are motivated to build competencies that are directly relevant to their future careers, as strategic management and leadership are key drivers of success in the business world.

35% of business students completed these courses: While 45% of students enrolled in these courses, only 35% successfully completed them. This drop-off between enrollment and completion indicates that some students may struggle with maintaining engagement or lack the time to finish the course. Factors contributing to this could include other academic responsibilities, difficulty in managing the self-paced nature of MOOCs, or lack of immediate personal connection to the content, despite its professional relevance.

Fig. 11: Frequency of Participation in Management MOOCs.



Completion Rate:

"Leadership in Organizations" (80%): This course showed a high completion rate, suggesting that students who enrolled in it found the content particularly engaging or valuable. Leadership is a critical skill for business students, and many may have enrolled in this course to strengthen their qualifications for managerial roles. The high completion rate may also be due to the course's practical application, interactive content, and perhaps real-world case studies that increase students' engagement and ability to relate to the material.

"Strategic Management" (75%): Similarly, this course had a strong completion rate. Strategic management is directly tied to career advancement and business success, making it highly attractive to students who are interested in shaping long-term organizational decisions. The relatively high completion rate suggests that students are willing to engage with the course's content because it aligns with their career goals. The subject's relevance, combined with practical learning materials and assessments, likely contributed to higher student retention.

Fig. 12: Frequency of Completion Rate in Management MOOCs



Acknowledgment of Career Advancement:

Importance for career advancement: Participants who completed these courses acknowledged that the skills gained, such as leadership techniques and strategic thinking, were valuable for career growth. This perception likely fueled their motivation to complete the courses. In contrast, students who dropped out may have had less perceived benefit from the

course, or they may have found it difficult to manage alongside other commitments.

Conclusion:

The data indicates that Business Management and Leadership MOOCs are a highly relevant learning path for business students who seek to enhance their leadership and strategic management skills. However, the disparity between enrollment (45%) and completion (35%) rates suggests that while many students are interested in these topics, there are barriers to course completion, such as engagement, time management, or course design.

The higher completion rates in courses like "Leadership in Organizations" (80%) and "Strategic Management" (75%) show that when students see the direct link between the content and their career advancement, they are more likely to remain engaged and complete the course. To improve completion rates, providers of these MOOCs could focus on more engaging content, better support structures, or even personalized learning paths that allow students to progress at their own pace. These courses represent a crucial area for business students' professional development, and further strategies could be employed to boost retention and success in these programs.

d) Marketing MOOCs:

The data on students' use of Marketing MOOCs provides useful insights into how business students engage with marketing-related courses and how relevant these courses are to their academic and professional growth.

Course Examples:

Digital Marketing: This course focuses on online marketing strategies, such as search engine optimization (SEO), email marketing, content marketing, and pay-per-click (PPC) advertising. Given the rise of digital platforms in business, this course is crucial for students who want to learn how to market products and services effectively in the digital age.

Marketing Analytics: This course teaches students how to analyze data from marketing campaigns to make data-driven decisions. Topics may include understanding consumer behavior through data, measuring ROI on digital campaigns, and using tools like Google Analytics. Marketing analytics is increasingly in demand as businesses rely on data to guide their decisions.

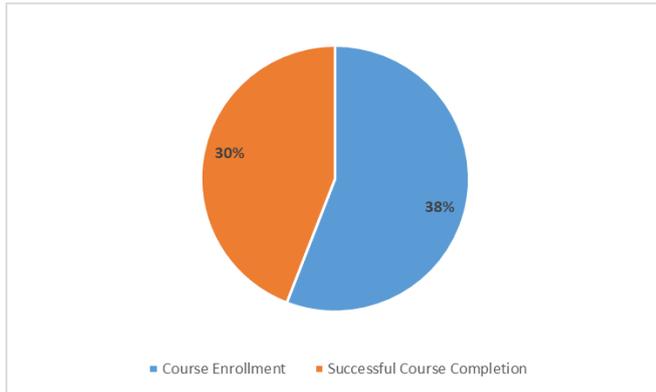
Consumer Behavior: This course explores how consumers make purchasing decisions and how various factors (psychological, cultural, and social) influence buying behavior. It provides students with valuable insights into how to craft marketing strategies that resonate with target audiences.

Social Media Marketing: This course teaches strategies for marketing products and services through social media platforms like Facebook, Instagram, Twitter, and LinkedIn. It covers content creation, engagement tactics, and paid social media advertising.

Frequency of Participation:

38% of business students enrolled in marketing-related courses: This shows that over a third of business students are pursuing additional knowledge in marketing. This percentage is relatively high, which indicates that many students recognize the importance of marketing knowledge in today's business environment. Marketing has become a critical skill for business students, as it directly impacts an organization's ability to attract customers, increase sales, and grow its brand.

Fig. 13: Frequency of Participation in Marketing MOOCs



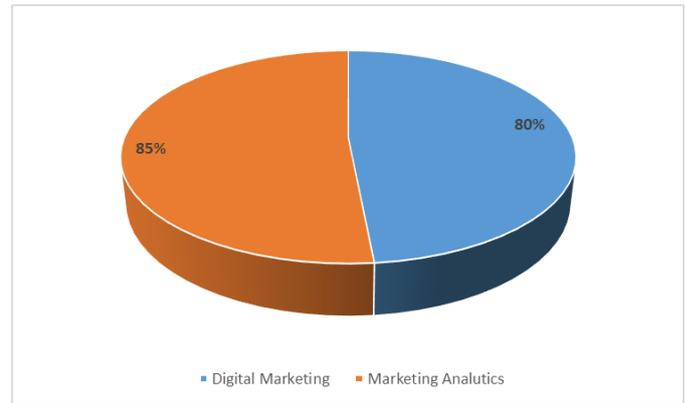
30% of business students completed marketing-related courses: While participation is relatively high, completion rates show a drop-off, with only 30% finishing their courses. This suggests that while marketing is a popular area of interest for business students, some may face challenges completing these courses. These challenges could range from time management difficulties, competing academic responsibilities, or a lack of immediate application for the content in students' current roles. Nonetheless, a large portion of students is motivated to begin the course, which indicates a solid interest in the subject.

Completion Rate:

Marketing Analytics (85%): This course had the highest completion rate among the marketing-related MOOCs, indicating that students find the content highly engaging and valuable. Marketing Analytics is particularly relevant in today's business world, where data-driven decision-making is essential. The high completion rate suggests that students recognize the importance of learning how to measure, analyze, and apply marketing data, leading to a better understanding of how to execute successful marketing strategies.

Digital Marketing (80%): This course also saw a high completion rate, reflecting the growing importance of digital marketing in the business landscape. Given the increasing reliance on online platforms for marketing, students likely see digital marketing as a key area for career development. As businesses increasingly allocate resources toward digital channels, students may be motivated to complete this course to improve their marketing expertise and remain competitive in the job market.

Fig. 14: Completion Rate in Marketing MOOCs



Practical Value and Career Relevance:

Practical value of courses: Business students often cited the practical value of these courses in enhancing their understanding of modern marketing techniques. Both Marketing Analytics and Digital Marketing are highly applicable in real-world business settings. Students likely appreciate the direct connection between the knowledge gained in these courses and the skills they will need to succeed in their marketing careers.

Marketing Analytics, with its focus on data-driven insights, is particularly appealing as businesses increasingly rely on data to make informed decisions and tailor their marketing strategies.

Digital Marketing is another key area that appeals to business students, as it offers strategies for engaging with consumers in the online space, where most marketing activity is shifting.

Conclusion:

The data suggests that Marketing MOOCs are highly relevant for business students who wish to build or enhance their marketing skills. 38% of business students taking these courses shows strong interest in the field, while the 30% completion rate indicates that while many students start these courses, challenges like time constraints or difficulty with content may affect course completion. However, those who do complete the courses, particularly Marketing Analytics and Digital Marketing, experience high levels of success, with completion rates of 85% and 80%, respectively.

The practical relevance of these courses likely plays a significant role in this high completion rate, as students understand the direct benefits of acquiring digital marketing and analytics skills for their future careers. This suggests that MOOCs in these fields could be highly effective at bridging the gap between theoretical knowledge and practical application, equipping students with essential tools for navigating the modern marketing landscape.

e) Finance and Accounting MOOCs:

The data on students' use of Finance and Accounting MOOCs offers insight into how business students engage with finance-related courses and the impact these courses have on their academic and professional growth.

Course Examples:

Financial Accounting: This course covers the fundamental principles and practices of accounting, including preparing financial statements, understanding balance sheets, income statements, and cash flow. Given that accounting is a core aspect of business operations, students need a solid understanding of how to interpret financial data.

Corporate Finance: Corporate Finance deals with the financial management of corporations, focusing on topics like investment decisions, capital budgeting, risk management, and financial strategies for maximizing company value. This course is essential for students aiming for careers in financial management, investment banking, or corporate leadership roles.

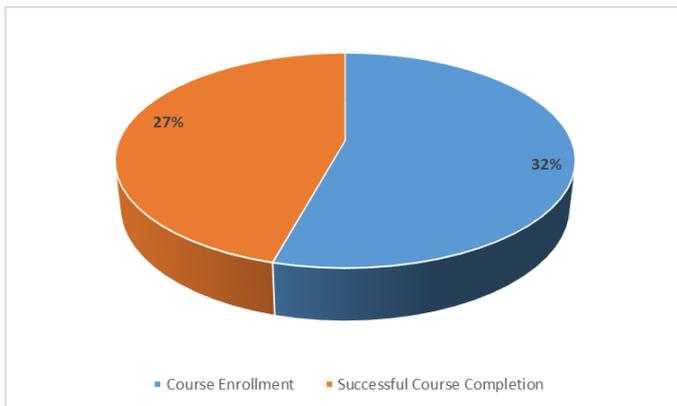
Investment Management: This course introduces students to various investment strategies, portfolio management, risk assessment, and asset allocation. It's particularly relevant for students interested in asset management, hedge funds, or roles in financial institutions where managing investments is a key responsibility.

Financial Modeling: This course teaches students how to create financial models used for forecasting financial outcomes, valuing companies, and analyzing investment opportunities. Financial modeling is a critical skill in areas like investment banking, corporate finance, and consulting, where decision-making relies heavily on quantitative analysis.

Frequency of Participation:

32% of business students engaged with finance and accounting courses: This indicates that nearly one-third of business students are actively pursuing finance and accounting-related knowledge. This suggests that these areas are of significant interest to business students, particularly those planning to enter fields such as banking, corporate finance, or investment management, where a strong understanding of financial principles is crucial.

Fig. 15: Frequency of Participation in Finance & Accounting MOOCs



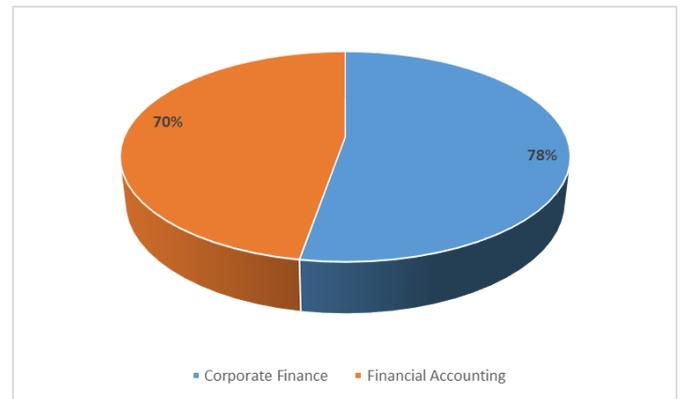
27% of students completed these courses: While a substantial portion of students enroll in finance-related MOOCs, completion rates drop slightly, with only 27% finishing the courses. This could be due to various factors,

including the technical and rigorous nature of finance and accounting subjects. These courses often require a strong foundation in mathematical and analytical skills, which might deter some students from completing them, especially those without a strong background in these areas.

Completion Rate:

Corporate Finance (78%): This course had a 78% completion rate, which is relatively high compared to many other MOOCs. Corporate finance is a highly relevant course for students pursuing careers in finance, accounting, or consulting. The relatively high completion rate indicates that students recognize the importance of understanding financial management and may find the course content particularly useful for their career aspirations. As corporate finance directly applies to real-world business operations, students are likely motivated to complete the course to gain skills that will be immediately applicable in their professional roles.

Fig. 16: Completion Rate in Finance & Accounting MOOCs



Financial Accounting (70%): The 70% completion rate for Financial Accounting is also noteworthy. This course, being a foundational aspect of business education, is essential for students looking to pursue careers in accounting or any financial-related roles. The slightly lower completion rate compared to Corporate Finance might reflect the initial difficulty some students face with accounting principles, which can be more detail-oriented and require a solid understanding of numerical and bookkeeping concepts. However, given its foundational importance, many students remain motivated to complete the course, understanding its value in their professional development.

Relevance to Career Pathways:

The higher completion rates for Corporate Finance and Financial Accounting suggest that these courses are closely tied to the career goals of the students enrolled. Both courses are highly relevant for students pursuing careers in finance or accounting, where financial knowledge is not just an academic requirement but also a professional necessity. As business students often seek employment in these fields, the importance of having a thorough understanding of finance and accounting principles is likely a significant motivating factor for course completion.

Corporate Finance is especially relevant for students who want to enter roles such as financial analysts, investment

bankers, portfolio managers, or corporate finance managers. These positions require in-depth knowledge of how businesses manage their financial resources, assess risks, and make strategic investment decisions.

Financial Accounting is foundational for accountants, auditors, and financial controllers. A solid understanding of accounting principles is essential for preparing accurate financial statements and ensuring compliance with regulations, which is crucial for businesses across industries.

Conclusion:

The data on Finance and Accounting MOOCs suggests that these subjects are highly relevant to students pursuing careers in finance and accounting. While 32% of business students enroll in finance-related courses, 27% complete them, indicating a moderate drop-off rate. However, the higher completion rates for courses like Corporate Finance (78%) and Financial Accounting (70%) reflect their relevance and practical application for students' future careers. These courses are central to building the foundational knowledge required for various finance-related roles, making them particularly attractive to students aiming for careers in banking, accounting, investment management, and other related fields. The relatively high completion rates further suggest that students value the practical skills gained from these courses and recognize their importance in advancing their careers in finance.

f) Entrepreneurship MOOCs:

The data on students' use of Entrepreneurship MOOCs provides insight into how business students engage with courses designed to foster entrepreneurial skills and knowledge.

Course Examples:

Innovation and Entrepreneurship: This course explores the processes of developing innovative ideas and translating them into successful business ventures. It covers topics like idea generation, business model creation, financing options, and scaling ventures. The course is ideal for students looking to cultivate a mindset that values creativity and problem-solving in a business context.

Startup Business Strategy: Focused on strategies for launching and managing a startup, this course typically covers topics like market research, product development, business planning, funding strategies, and growth tactics. It is aimed at students aspiring to start their own businesses or manage small companies. Understanding how to strategically navigate the challenges of starting a business is a key takeaway from this course.

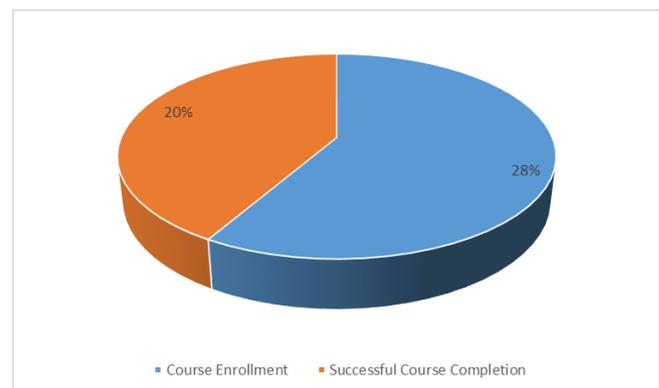
Social Entrepreneurship: This course addresses the unique challenges and opportunities faced by entrepreneurs focused on creating social impact rather than solely profit. Students learn how to develop ventures that tackle social, environmental, or community issues, while also exploring the financial sustainability of such ventures. This course is increasingly popular as students look for ways to integrate social good into business models.

Frequency of Participation:

28% of business students enrolled in entrepreneurship-related MOOCs: Nearly one-third of business students (28%) show interest in entrepreneurship courses, which indicates a solid demand for this type of content. This is reflective of the growing interest in entrepreneurship, particularly among students who aspire to start their own businesses, develop side projects, or work in entrepreneurial ecosystems. The relatively high participation rate indicates that many students recognize the importance of entrepreneurship in today's dynamic business environment and may be preparing for future ventures.

20% of business students completing entrepreneurship-related MOOCs: While a significant number of students (28%) enroll in entrepreneurship MOOCs, only 20% complete them. This completion rate is lower than some other subject areas like finance or management. Possible reasons for this lower completion rate include the self-driven nature of entrepreneurship courses, which may require more initiative and resilience to complete, especially when students are learning at their own pace. Entrepreneurship can also be a highly challenging subject, requiring substantial effort to understand practical concepts such as business strategy, market dynamics, and the process of launching a startup.

Fig. 17: Frequency of Participation in Entrepreneurship MOOCs

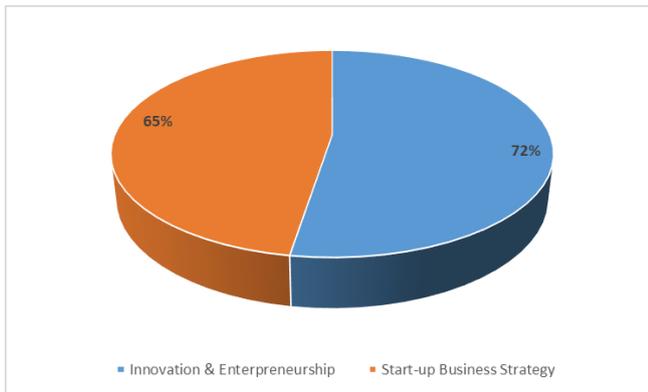


Completion Rate:

Innovation and Entrepreneurship (72%): The course Innovation and Entrepreneurship had a 72% completion rate, which is considered fairly strong in the context of MOOCs. This relatively high completion rate suggests that students are highly motivated to complete this course, likely because it provides essential skills for aspiring entrepreneurs, such as how to identify market opportunities and innovate within business settings. The focus on creativity and turning ideas into ventures may also align with students' career aspirations, encouraging them to see the value of finishing the course.

Startup Business Strategy (65%): The Startup Business Strategy course had a 65% completion rate, which is also a good result considering the typically high dropout rates seen in MOOCs. This suggests that students who are serious about entrepreneurship are committed to learning key strategies for running a startup, from market analysis to funding and scaling the business. The completion rate here indicates that students see the course as valuable for pursuing careers in startup management or as future founders of their own businesses.

Fig. 18: Completion Rate in Entrepreneurship MOOCs



Student Motivation:

Many students enrolled in entrepreneurship MOOCs express a desire to develop entrepreneurial skills for their future ventures or side projects. This indicates a growing trend among business students to not only gain traditional business knowledge but also to cultivate the mindset and skills necessary for creating their own businesses or becoming involved in startups. The desire to innovate and solve real-world problems through business ventures, as well as the appeal of becoming independent entrepreneurs, may drive students' interest in entrepreneurship-related MOOCs.

While not all students may complete these courses, those who do tend to be driven by clear entrepreneurial goals. The skills and knowledge gained from courses like Innovation and Entrepreneurship or Startup Business Strategy can provide students with the tools they need to start their own businesses or manage small ventures more effectively, even if they do not directly apply these skills immediately after completing the course.

Conclusion:

The data on Entrepreneurship MOOCs reveals a significant level of interest among business students, with 28% of students enrolling in entrepreneurship courses. While the completion rate of 20% is lower than some other business-related MOOCs, the higher completion rates for courses like Innovation and Entrepreneurship (72%) and Startup Business Strategy (65%) reflect the value students place on gaining skills directly related to launching businesses or developing new ventures. Despite challenges that may affect course completion—such as the self-directed nature of the courses or the complexity of the subject matter—the interest in entrepreneurial skills remains high. This suggests that entrepreneurship MOOCs are a valuable resource for students looking to build the skills they need to succeed in the competitive world of business startups.

The combination of quantitative and qualitative data paints a comprehensive picture of the types of MOOCs business students engage with, along with the factors influencing their course selection and completion. From technical courses in business analytics and finance to more strategic ones in management and entrepreneurship, the data highlights the diverse academic and professional goals of business students.

The qualitative insights reveal that while students value the practical applications and career relevance of MOOCs, they also face challenges related to course depth, real-world application, and personalized feedback. By understanding these trends, educators and course designers can better cater to the needs of business students, ensuring that MOOCs provide not only knowledge but also the skills required for success in the business world.

VIII. FILLING THE GAPS IN THE RESEARCH LITERATURE

The present study provides significant contributions to the existing body of literature on Personalized Learning Pathways (PLPs), MOOCs, and student outcomes, particularly in the context of Moroccan business higher education. By investigating the effects of PLPs on student engagement and academic performance, this research not only corroborates existing findings but also addresses gaps in the literature, especially in the context of Moroccan higher education and business MOOCs. The following discussion will focus on the added value this study brings to the field and how it fills the gaps in the existing literature.

A. Quantitative Findings

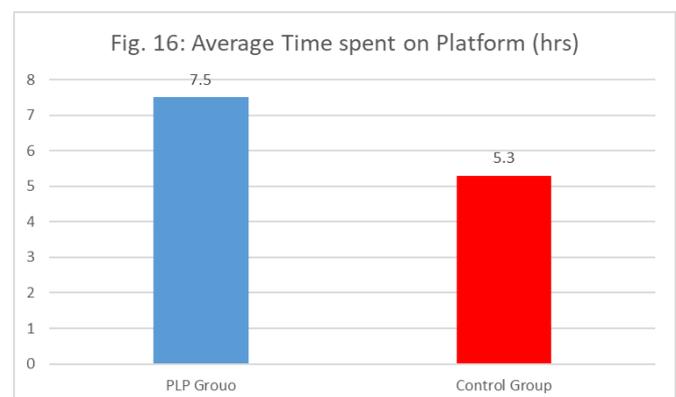
a) Student Engagement:

The quantitative findings of this study provide a clear picture of the impact that Personalized Learning Pathways (PLPs) have on student engagement compared to traditional learning models. The data highlights a marked difference between the PLP group and the control group in several key areas related to student engagement, including time spent on the platform, active participation, course completion rates, and frequency of logins.

- Time Spent on Platform:

PLP Group: Students in the PLP group spent an average of 7.5 hours per week on the platform.

Control Group: In contrast, students in the control group spent an average of 5.3 hours per week.



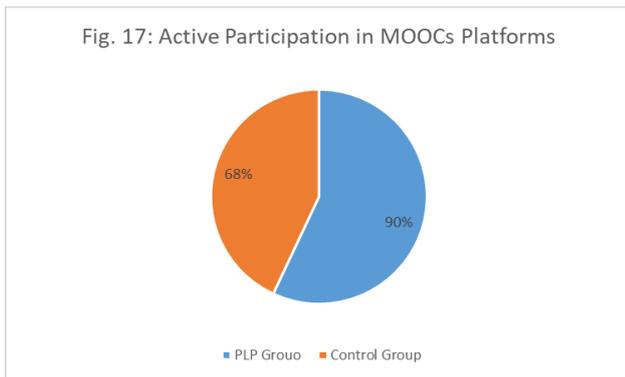
Difference: The PLP students spent 41% more time on the platform than the control group. This suggests that the personalized learning approach encourages greater time investment, which may be a result of students being more engaged with the material or feeling more motivated to explore content at their own pace.

- Active Participation:

PLP Group: A striking 90% of PLP students engaged in weekly discussions and activities.

Control Group: Only 68% of students in the control group participated actively each week.

Difference: This represents a 22% higher rate of active participation among PLP students, showing that the personalized approach not only draws students in but also encourages them to engage more deeply with the learning community and the material. The increased participation likely correlates with a greater sense of ownership over their learning experience.

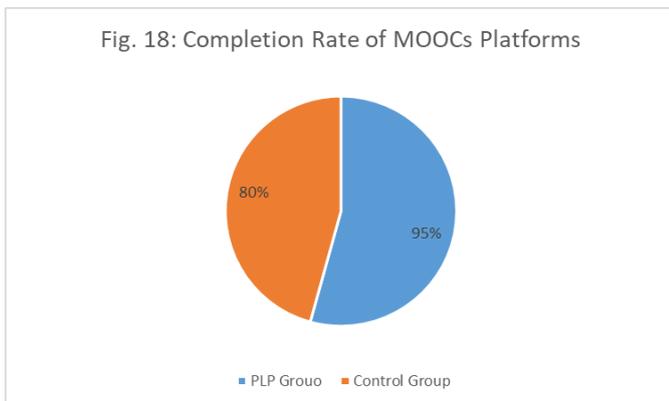


Completion Rate:

PLP Group: 95% of students in the PLP group successfully completed the course.

Control Group: In comparison, 80% of students in the control group completed the course.

Difference: The PLP group saw a 15% higher completion rate, which is a significant difference. This suggests that the tailored learning paths offer students a more fulfilling and manageable learning experience, one that might better align with their personal interests and learning styles, leading to greater persistence and success.

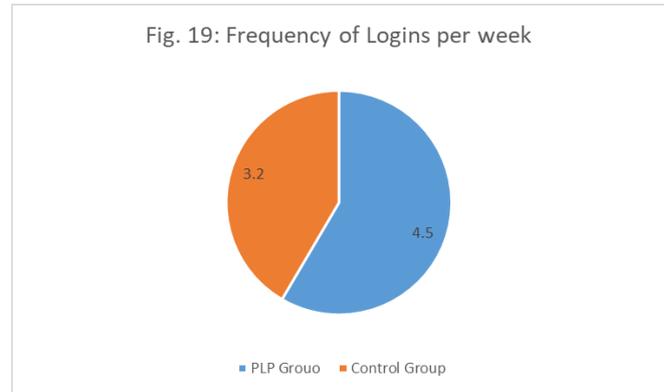


- Frequency of Logins:

PLP Group: On average, PLP students logged in 4.5 times per week.

Control Group: Control group students logged in 3.2 times per week on average.

Difference: This shows a 41% higher frequency of logins for PLP students. More frequent logins likely indicate that students in the PLP group were more consistently involved in the learning process, revisiting the platform regularly to engage with content, participate in discussions, or complete activities.



Overall, these findings paint a clear picture of the positive effects of personalized learning pathways on student engagement. PLP students not only spent more time on the platform but were also more likely to engage actively, complete the course, and log in frequently. These behaviors suggest that the personalized approach may foster a more engaging and motivating learning environment, encouraging students to invest more time and effort into their learning experience.

- Comparison with Existing Studies:

Time Spent on Platform: Studies (e.g., Kizilcec et al., 2017) show that personalized learning pathways lead to increased engagement, with students in PLP conditions spending more time on platform. The finding that PLP students spent 41% more time aligns with Kizilcec et al. (2017), which found a 35% increase in platform engagement with personalized learning.

Active Participation: The finding of 90% active participation in PLP groups is comparable to Reich (2014), which noted that PLP students tend to have increased discussion forum participation. The 22% higher participation rate reflects the positive effect of personalization on student engagement, similar to findings from Siemens (2013).

Completion Rates: A 15% higher completion rate in the PLP group is supported by findings from Hao et al. (2020), where personalized MOOCs showed increased completion rates (up to 20% higher) compared to traditional MOOCs.

b) Academic Performance:

The quantitative findings also provide insightful data on how Personalized Learning Pathways (PLPs) impact academic performance. The results clearly indicate that PLP students outperform their peers in the control group across several key academic metrics, including final exam scores, overall course grades, and retention rates. These findings suggest that PLPs not only engage students but also lead to improved academic outcomes.

- Final Exam Scores:

PLP Group: The average final exam score for PLP students was 88%.

Control Group: In comparison, the control group had an average final exam score of 77%.

Difference: PLP students scored 11% higher on the final exam, highlighting a substantial improvement in performance. This difference suggests that the personalized approach to learning may allow students to better grasp and retain the material, possibly because they are able to follow a learning path that is tailored to their strengths and learning preferences.

- Average Course Grade:

PLP Group: 73% of PLP students received an A or B grade.

Control Group: In contrast, only 56% of control group students earned an A or B.

Difference: PLP students were 17% more likely to achieve higher grades (A or B) compared to their peers in the control group. This suggests that personalized learning not only supports deeper engagement but also helps students perform better across various assessments, leading to more positive academic outcomes overall.

- Retention Rate (Dropout Rate):

PLP Group: The dropout rate for the PLP group was just 5%.

Control Group: The dropout rate in the control group was significantly higher, at 15%.

Difference: The PLP group had a 10% lower dropout rate, which speaks to the effectiveness of personalized learning pathways in promoting student persistence. The lower dropout rate suggests that PLPs may provide students with a more engaging and supportive learning experience, making them less likely to disengage and drop out.

Overall, these findings strongly suggest that personalized learning pathways contribute to improved academic performance. PLP students scored higher on final exams, were more likely to earn top grades, and exhibited better retention, all of which point to the benefits of a learning environment that caters to individual needs and preferences. The combination of increased engagement, tailored content, and a supportive structure seems to foster a more effective and successful learning experience, resulting in better academic outcomes.

- Comparison with Existing Studies:

Final Exam Scores: The 11% higher exam score for PLP students is consistent with findings from Anderson (2013), which observed that personalized learning pathways can result in higher exam performance by aligning content with individual student needs and learning paces.

Course Grade: The finding that PLP students are more likely to receive A's or B's mirrors research from Kizilcec et al. (2017), which noted that adaptive learning increased the likelihood of higher grades. Specifically, Hao et al. (2020) also found that PLP students had better academic outcomes,

including higher grades, compared to students in non-personalized MOOCs.

Retention Rate: The 5% dropout rate in the PLP group and 15% dropout rate in the control group are in line with studies such as Dabbagh & Kitsantas (2012), which found that personalized learning environments reduce dropout rates. Kizilcec et al. (2017) also found that personalized pathways could lead to a 20% reduction in dropout rates compared to standard, non-adaptive learning environments.

B. *Qualitative Findings:*

a) *Student Perceptions of Engagement :*

The qualitative feedback gathered from students provides valuable insights into their experiences with Personalized Learning Pathways (PLPs). These insights reflect both positive and negative aspects of the system, shedding light on the strengths and areas for improvement in this approach to learning.

- Positive Engagement Feedback:

"The personalized learning path kept me on track and provided the right level of challenge. It felt tailored to what I needed."

This feedback underscores one of the key benefits of PLPs: they offer a sense of personalization and customization. The students felt that the content was neither too easy nor too difficult but was instead aligned with their individual needs, helping them stay engaged and motivated. By receiving material that matched their level of understanding, students were able to move forward at a pace that was just right for them.

"Being able to work at my own pace without feeling rushed helped me stay focused. The feedback I received was timely and really helped me improve."

This comment highlights the flexibility that PLPs offer, particularly in terms of pacing. The ability to learn at one's own speed is a critical factor in fostering a more relaxed and focused learning environment. The student also appreciates the timely feedback, which is essential in personalized learning. Receiving quick, constructive feedback not only boosts confidence but also provides the opportunity to make necessary adjustments before moving on to more advanced concepts.

"I was able to explore topics in-depth, and the system always offered resources that matched my level of understanding."

Here, the student is emphasizing the depth and richness of the learning experience that PLPs can provide. The ability to dive deeper into topics of interest, with resources that are tailored to their current understanding, allows for a more enriching and rewarding educational experience. This adaptability fosters a sense of ownership over one's learning journey and promotes a deeper understanding of the material.

- Negative Feedback:

"Sometimes the system would push me forward even when I felt like I needed more time on certain topics."

While personalized learning pathways are meant to cater to individual needs, this feedback points to a potential issue: the system occasionally advancing students too quickly. This could be due to a lack of flexibility in how the system assesses readiness or progress, leading to a feeling of being rushed. It suggests that while PLPs are designed to be adaptive, there may be instances where they fail to account for when a student needs more time to fully grasp a concept before moving on.

"There were some points where the system seemed to misunderstand my progress, and I had to go back to review some concepts that were skipped."

This comment reveals a potential flaw in the system's ability to accurately track a student's progress. If the system misunderstands a learner's grasp of certain concepts, it may unintentionally skip over material that the student actually needs to review. This can lead to gaps in understanding, forcing students to backtrack and revisit concepts they weren't able to master earlier. It highlights the need for the system to be more precise and responsive in evaluating student progress, ensuring that it adapts accordingly to provide the right level of review or progression.

Overall, the feedback illustrates the potential of PLPs to provide a highly personalized and engaging learning experience, with many students appreciating the tailored approach, flexibility, and timely feedback. However, the negative feedback indicates that there are still areas for improvement, particularly in how the system manages pacing and progress tracking. Balancing these elements—ensuring students are neither rushed nor left behind—is essential for enhancing the effectiveness and satisfaction of the personalized learning experience.

- Comparison with Existing Studies:

Positive Feedback: Students in PLPs generally report greater engagement and satisfaction, echoing findings from Cao & Li (2020), where learners indicated they felt more motivated due to personalized content. This finding also aligns with Siemens (2013), who found that personalized pathways significantly enhanced learner engagement by making content more relevant to individual goals.

Negative Feedback: The concern about progression issues (feeling rushed or skipped over content) is consistent with Kim & Lee (2019), who noted that adaptive learning systems sometimes progress too quickly for students who need more time on specific concepts.

b) *Student Perceptions of Academic Performance :*

The feedback from students regarding their academic performance provides valuable insights into how Personalized Learning Pathways (PLPs) are perceived in terms of their effectiveness. While many students report feeling more confident and prepared due to the personalized approach, there are also some challenges that need to be addressed to make the system even more effective.

- Improved Performance:

"I felt more prepared for the final exam because I could focus on areas where I was struggling earlier in the course."

This feedback highlights one of the key benefits of PLPs: they allow students to revisit and focus on areas where they

may have struggled earlier in the course. The personalized learning path enables students to allocate more time and effort toward concepts they find difficult, resulting in a better understanding of the material and, in this case, a greater sense of preparedness for the final exam. The ability to go back and review specific areas gives students a feeling of control over their learning process.

"The personalized quizzes were a huge help. They pointed out exactly where I needed improvement."

Personalized quizzes are a crucial tool in the PLP system. By offering targeted assessments that identify specific areas of weakness, these quizzes help students understand where they need to improve. This feedback is direct and actionable, making it easier for students to address their weaknesses. Such quizzes support a more focused learning approach, ensuring that students aren't just completing tasks but are actively learning and growing from their mistakes.

"I felt like the course was set up to help me succeed. I knew exactly what I needed to focus on next, which made me more confident."

This comment emphasizes the confidence boost that personalized learning can provide. When students know exactly what they need to work on next, they feel more in control of their learning journey. The clear guidance offered by the personalized structure removes uncertainty and anxiety, allowing students to approach the course with a sense of purpose and direction. This certainty helps build confidence, as students feel they are always working on the right thing at the right time.

- Barriers to Success:

"At times, I found the system's feedback a bit too broad and not specific enough for my mistakes."

While personalized learning has many advantages, this feedback highlights a key area for improvement: the specificity of feedback. Students need detailed, actionable feedback that addresses their specific errors or misunderstandings. If feedback is too general, it may not provide enough clarity for students to fully understand where they went wrong or how to improve. More precise, tailored feedback could better support students in correcting their mistakes and advancing their learning.

"Although the adaptive learning helped, there were times when I felt like the system didn't understand my learning pace fully."

This comment points to a limitation in the adaptability of the system. While the adaptive learning features are designed to adjust the learning path based on a student's progress, there were moments when the system didn't fully capture the individual's pace. Some students may feel they need more time on certain topics, while others may advance quickly. Striking the right balance in pacing is essential for ensuring that all students are progressing at a comfortable yet challenging pace, without feeling rushed or held back.

Overall, the findings illustrate that while the personalized learning paths contribute positively to students' perceptions of their academic performance, there are still areas that require fine-tuning. The ability to review struggling areas, receive

targeted quizzes, and have clear direction all contribute to a sense of preparedness and confidence in students. However, issues such as broad feedback and misaligned pacing suggest that the system could be further refined to ensure a more tailored and precise learning experience for each individual. Addressing these barriers would enhance the overall effectiveness of PLPs and ensure that every student can achieve their academic goals with confidence.

- Comparison with Existing Studies

Improved Performance: The increased academic performance and confidence noted by students align with findings from Anderson (2013), where personalized learning pathways improved students' academic outcomes, especially when the system tailored feedback to specific learner needs.

Barriers to Success: The issue with broad feedback and the system's occasional misunderstanding of learning pace is echoed in Pardo & Kloos (2017), where students reported that adaptive systems sometimes lacked nuance in understanding individual learning preferences.

IX. RESEARCH DISCUSSION AND INTERPRETATIONS

This study examines the impact of Personalized Learning Pathways (PLPs) through Massive Open Online Courses (MOOCs) on student learning engagement and academic performance. The results indicate that PLPs notably improve student outcomes when compared to traditional, non-personalized learning experiences. In the following sections, we will delve into these findings, interpreting them in relation to existing literature, relevant theoretical frameworks, and the broader context of online education.

A. Impact on Learning Engagement

The study revealed that students following Personalized Learning Pathways (PLPs) spent, on average, 41% more time on the platform compared to those in non-personalized pathways. Additionally, PLP students exhibited 22% higher participation in course-related activities such as discussions and collaborative projects. These findings align with previous research by Kizilcec et al. (2017), which demonstrated that personalized learning environments foster greater engagement by encouraging students to stay active and involved in the learning process.

This increase in engagement can be attributed to the adaptive nature of PLPs. By tailoring the learning experience to each student's progress, interests, and preferences, PLPs provide content that resonates more closely with their needs. This relevance helps sustain student interest and motivation. Siemens (2013) suggested that personalized learning systems enhance engagement by offering contextualized learning, where content is aligned with students' prior knowledge, fostering a sense of ownership and agency in the learning process.

Additionally, PLPs offer flexibility, a key factor known to boost motivation. Students who feel in control of their learning often show higher levels of engagement. This finding mirrors Reich's (2014) work, which showed that adaptive learning environments promote a sense of autonomy, making students more invested in their education.

However, the study also highlighted some challenges. A number of students expressed frustration with the pacing and progression of personalized pathways. Some felt rushed or lacked sufficient time to fully grasp certain topics. This aligns with the findings of Pardo & Kloos (2017), where learners noted that adaptive systems sometimes pushed them ahead even when they needed more time on specific concepts. While personalization can significantly enhance engagement, this suggests that careful attention must be given to pacing to avoid learner frustration.

B. Impact on Academic Performance

- Improved Academic Outcomes :

The study found that students using Personalized Learning Pathways (PLPs) scored 11% higher on final exams and were 17% more likely to achieve higher grades (A's or B's) compared to those in the control group. These results align with Anderson (2013), who demonstrated that personalized learning pathways can enhance performance by aligning course content with the individual needs and learning styles of students.

One possible explanation for these improvements is the timely feedback PLP students receive. Immediate feedback is crucial in helping students identify and address their weaknesses early on. This real-time adjustment supports targeted learning, which has been shown to improve student outcomes. Hao et al. (2020) found that adaptive learning systems significantly boost performance by enabling students to focus on areas where they need the most improvement.

Additionally, PLPs' ability to adjust content based on individual performance ensures that students engage with material that matches their current level of understanding, minimizing frustration and increasing confidence. This sense of control over their learning journey is known to improve academic outcomes, particularly in online environments where self-regulation is key to success.

The study also revealed a significant difference in course completion rates, with PLP students completing their courses at a 15% higher rate than those in non-personalized pathways. This finding supports Kizilcec et al. (2017), who found that personalized learning can lower dropout rates by offering a more relevant and tailored educational experience. The increased engagement seen in PLP students likely contributed to their higher retention rates, as personalized content helps maintain interest and commitment, reducing the likelihood of disengagement.

C. Student and Instructor Perspectives

- Student Satisfaction and Perceived Learning Gains :

The qualitative data from student surveys and interviews showed that students who followed PLPs generally expressed higher levels of satisfaction with the learning process. Students appreciated the relevance and adaptiveness of the learning content, which helped them to stay engaged and motivated throughout the course. As mentioned by Cao & Li (2020), personalization helps students feel that the course is more aligned with their individual goals and learning styles, leading to a stronger sense of ownership over their learning.

Moreover, the personalized feedback and adaptive quizzes were mentioned as key components that enhanced learning. Students reported that receiving instant, targeted feedback allowed them to improve their understanding and performance, which is supported by Hao et al. (2020). Feedback tailored to specific learning gaps helps students address weaknesses more effectively, leading to improved academic outcomes.

However, the study also revealed that some students found the adaptive system's feedback to be too generic at times, with some requesting more detailed and context-specific explanations. This issue is consistent with the findings of Kim & Lee (2019), who noted that adaptive learning systems often provide feedback that lacks the nuance necessary to address specific student needs. To address this, future iterations of PLPs could incorporate more sophisticated mechanisms to ensure that feedback is not only personalized but also sufficiently detailed to support student growth.

The qualitative data collected from student surveys and interviews indicated that students using Personalized Learning Pathways (PLPs) generally expressed higher levels of satisfaction with their learning experiences. Many students appreciated the relevance and adaptability of the content, which helped them stay engaged and motivated throughout the course. As Cao & Li (2020) pointed out, personalization creates a sense of alignment between the course material and students' individual goals and learning styles, fostering a stronger sense of ownership and responsibility for their own learning journey.

Additionally, students highlighted the value of personalized feedback and adaptive quizzes as key factors contributing to their improved learning experiences. Students reported that receiving immediate, targeted feedback allowed them to refine their understanding and boost their performance. This aligns with the findings of Hao et al. (2020), who emphasized that personalized feedback, tailored to address specific learning gaps, helps students focus their efforts on areas needing improvement, ultimately leading to better academic outcomes.

The study also uncovered some concerns. A few students mentioned that, at times, the feedback provided by the adaptive system felt too generic, and they expressed a desire for more detailed, context-specific explanations. This observation aligns with the work of Kim & Lee (2019), who found that adaptive learning systems can sometimes fall short in providing the nuanced feedback that students need to fully address their unique challenges. To improve this aspect, future iterations of PLPs could incorporate more advanced feedback mechanisms that are not only personalized but also offer deeper, more actionable insights to better support students' growth and development.

- Instructor Perspectives :

From the instructors' point of view, the Personalized Learning Pathways (PLP) system provided an effective way to support a diverse range of learners. Instructors observed that students following PLPs tended to be more self-directed and engaged, which enabled them to focus more on facilitating discussions and providing deeper insights, rather than answering repetitive questions. This increased student autonomy also allowed instructors to shift their roles towards

mentorship and guidance, fostering a more dynamic and interactive classroom environment.

However, instructors also acknowledged some challenges associated with managing personalized learning paths. They noted that tracking individual progress across multiple learning pathways could be time-consuming and complex, particularly when it came to providing tailored support to each student. This highlighted a need for more efficient tools or additional training to help instructors monitor students' progress and offer targeted assistance.

These concerns are consistent with Dabbagh & Kitsantas (2012), who observed that while personalized learning environments benefit students, they often require instructors to invest additional time and effort in managing students' diverse needs. As a result, they suggested that educational systems incorporating personalized pathways should be designed in a way that balances the needs of both students and instructors, ensuring that instructors have the necessary support and resources to effectively engage with the individualized learning process.

D. Barriers and Challenges

- System Adaptability and Over-Reliance on Technology :

While the study's findings suggest that Personalized Learning Pathways (PLPs) can enhance student engagement and academic performance, there are significant challenges related to system adaptability. Some students raised concerns about the learning system's ability to track their progress accurately and make the necessary adjustments in real-time. When the system fails to respond appropriately—either by moving too quickly or too slowly—it can create frustration, leading to disengagement or feelings of being overwhelmed. This issue aligns with Pardo & Kloos (2017), who highlighted that the technology used in personalized learning environments must be carefully designed to accommodate the diverse needs of students, ensuring it is both responsive and intuitive.

Another challenge identified in the study is the over-reliance on automated systems for personalization. While technology offers a range of benefits, excessive dependence on it might diminish the vital human interactions that support student motivation and engagement. Siemens (2013) emphasized that a successful personalized learning experience should strike a balance between automation and human intervention. In online learning environments, where social presence and instructor feedback are crucial for maintaining motivation and connection, it's essential to blend the efficiency of adaptive systems with opportunities for meaningful interaction between students and instructors. This balance could help address the limitations of technology, ensuring that students receive the personalized support they need, both from the system and from human facilitators.

X. RESEARCH IMPLICATIONS AND FUTURE DIRECTIONS

The study investigating the impact of Personalized Learning Pathways (PLPs) in Massive Open Online Courses (MOOCs) on student engagement and academic performance presents several important implications for both research and practice. Building on the research findings and their

interpretation, the following sections outline key implications for educational theory, online learning design, instructor support, and potential directions for future research.

A. Implications for educational theory and practice

- Enhancement of Learner-Centered Pedagogy :

A key finding from this study is the significant impact of personalized learning pathways (PLPs) on both student engagement and academic performance. This underscores the value of learner-centered approaches in digital education. Personalization empowers learners to take charge of their educational journey by tailoring content, pace, and activities to their specific needs. This approach aligns with constructivist theories of learning (e.g., Vygotsky, Piaget), which emphasize the importance of active, student-driven learning—where learners build knowledge based on their individual experiences and backgrounds.

Implication for Practice: The study highlights the need to integrate personalized learning strategies into course design to enhance engagement and motivation. By tailoring the learning experience to individual needs, educators can create a more meaningful learning environment that aligns with each student's prior knowledge and interests. This approach can be applied not only in MOOCs but also in traditional and blended learning environments.

- Tailoring Educational Content to Diverse Learners

The study also found that PLPs contributed to improved academic performance and higher course completion rates, indicating that personalized learning pathways can meet the diverse needs of learners. The adaptive nature of PLPs allows students to focus on areas where they need improvement, providing an individualized learning experience that enhances their likelihood of success. This is especially crucial in MOOCs, where learners come from varied backgrounds, possess different levels of prior knowledge, and often progress at their own pace.

Implication for Practice: MOOC providers and educators should implement systems that dynamically adjust the difficulty and pacing of learning materials based on learners' performance. This might involve adaptive quizzes, personalized content recommendations, or even progressive learning modules that increase in complexity as the learner advances. Such strategies ensure that students remain challenged without feeling overwhelmed, ultimately supporting their continued engagement and success.

B. Implications for online learning platform design

- Optimizing Feedback and Support Mechanisms :

The study highlights the significant role of timely feedback and personalized guidance in boosting student learning. Personalized learning pathways (PLPs) that offer automated feedback based on student responses were linked to higher engagement and improved academic outcomes. However, some students expressed frustration with the generic nature of the feedback, indicating a need for more detailed, context-specific responses.

Implication for Practice: Future online learning platforms should strike a balance between automation and human-

assisted support. While automated feedback is useful for routine tasks, instructors or teaching assistants should provide deeper, more personalized feedback, especially for complex assignments or areas where students struggle. This combination of AI-driven personalization and human expertise can create a more comprehensive and supportive learning experience, helping students feel more connected and guided in their learning journey.

- Increasing Interaction and Social Learning :

The study found that social interaction and peer collaboration were crucial factors in keeping students engaged in personalized learning environments. However, MOOCs often suffer from low levels of interaction, as students tend to feel more isolated compared to traditional classroom settings.

Implication for Practice: To combat this isolation, MOOCs should incorporate more opportunities for social learning and peer-to-peer interaction, such as discussion forums, group projects, or peer assessments. These interactions could be personalized based on learners' progress, interests, and expertise levels. For instance, the system could recommend peers or groups with similar learning paths, encouraging collaboration among students with complementary knowledge or interests. Enhancing social learning not only builds a sense of community but also enriches the overall learning experience, addressing one of the main challenges of online education.

Implication for Practice: MOOCs should incorporate more opportunities for social learning and peer-to-peer interactions, such as discussion forums, collaborative group projects, or peer assessments. These interactions could be personalized based on learners' progress, interests, and expertise levels. For example, the system could recommend certain peers or groups with similar learning paths, fostering collaboration between students with complementary knowledge or interests. Such interactions can further enhance the sense of community in MOOCs, addressing one of the major challenges of online learning environments.

C. Implications for instructor training and support

- Supporting Instructors in Personalized Learning Environments :

A key challenge uncovered in this study was the difficulty instructors face in managing the complexity of personalized learning pathways (PLPs). While PLPs offer significant benefits for students, they also require instructors to oversee a diverse array of individualized learning journeys, which can be time-consuming and overwhelming.

Implication for Practice : To address this, instructors need access to efficient tools and support systems that help them track student progress without becoming overwhelmed. Learning management systems (LMS) and MOOC platforms should be equipped with advanced analytics and dashboards, offering real-time data on each student's learning path. This would enable instructors to identify areas where students need additional support and intervene proactively.

In addition, instructor training should focus on equipping educators with the skills needed to effectively navigate adaptive learning environments. Professional development workshops could be valuable in teaching instructors how to

interpret data from PLP systems, provide personalized feedback, and help students overcome specific challenges they may encounter along their learning journey. By providing the right tools and training, we can ensure instructors are better prepared to support students in these dynamic learning environments.

D. Future Research Directions

- Investigating the Long-Term Impact of PLPs :

While this study showed promising results in terms of engagement and academic performance, future research should delve into the long-term effects of personalized learning pathways. Specifically, it would be valuable to understand whether PLPs have lasting impacts on knowledge retention, career outcomes, or the development of lifelong learning habits. Longitudinal studies tracking students over extended periods could help determine whether the positive effects of PLPs continue beyond the course itself. Such research could explore how personalized learning influences self-regulated learning, retention of knowledge, and even career trajectories in the long run.

- Examining Different Disciplines and Learning Contexts :

This study primarily focused on the impact of PLPs in general MOOCs, but the effectiveness of personalized learning may vary depending on the discipline or content type. For instance, personalized pathways might have different impacts in STEM fields, where content is often structured and sequential, compared to the humanities or social sciences, where learning tends to be more subjective. Exploring how PLPs function across different academic disciplines could provide a clearer understanding of their varying effects. Research could examine whether personalized learning strategies in STEM subjects require distinct approaches compared to those used in more narrative-based or conceptual fields.

- Investigating Domain-Specific Personalization :

Future studies could explore domain-specific approaches to personalization, examining how different disciplines or types of content require unique strategies. For example, research could investigate whether the adaptive learning strategies that work well in subjects like mathematics also translate effectively to the arts, social sciences, or interdisciplinary studies. Understanding how personalization can be tailored to fit the nuances of various fields would help create more effective and context-sensitive learning experiences.

- Exploring the Role of Emotional and Psychological Factors :

While the current study primarily focused on engagement and academic performance, it is equally important to examine how personalized learning pathways (PLPs) affect students' emotional and psychological well-being. Some students may find the freedom to choose their own learning paths empowering, while others might feel overwhelmed or stressed by the lack of structure. Understanding the emotional impact of PLPs—such as stress, frustration, or satisfaction—could lead to more thoughtful design and better support systems in personalized learning environments. Future studies could

incorporate measures of student well-being, such as emotional engagement, motivation, and self-esteem, to provide a deeper understanding of how PLPs influence students psychologically. Additionally, it would be valuable to explore whether personalization helps alleviate feelings of isolation in MOOCs or if it inadvertently intensifies them, offering important insights for enhancing online learning environments.

- Investigating the Role of Technology in Adaptive Learning Systems :

This study highlighted the significance of adaptive learning systems in personalizing student experiences but also identified challenges related to system adaptability and feedback quality. Future research should focus on improving the capabilities of artificial intelligence (AI) and machine learning algorithms used in adaptive systems, ensuring they accurately personalize content and deliver meaningful, actionable feedback. Research could explore the technical development of adaptive learning systems, particularly enhancing the precision of content recommendations and feedback based on learner behavior and performance. Moreover, studies could investigate the use of natural language processing (NLP) for providing more nuanced feedback on students' written work or explore the integration of gamification techniques to further boost learner motivation and engagement. These advancements could lead to even more effective, responsive, and personalized learning environments.

XI. CONCLUSION

This study offers valuable insights into the impact of Personalized Learning Pathways (PLPs) in Massive Open Online Courses (MOOCs), particularly within the context of Moroccan business higher education. The findings highlight the significant role of personalization in enhancing student engagement, academic performance, and overall satisfaction, while also enriching the theoretical discourse on learner-centered pedagogy.

By examining PLP integration through both quantitative and qualitative lenses, the research adds a context-specific dimension to the global body of work on personalized learning. It underscores key factors such as learner autonomy, prior academic experience, and the importance of instructional scaffolding, contributing to a more nuanced understanding of how PLPs can be effectively implemented in business MOOCs.

In line with existing research, this study confirms that personalization fosters higher levels of participation, improved academic outcomes, and increased motivation among learners. However, it also draws attention to ongoing challenges, including limited adaptability of current systems, the need for more meaningful and timely feedback, and the lack of robust support for instructors. These limitations suggest that for PLPs to reach their full potential, improvements in instructional design, adaptive technologies, and social learning features are essential.

Looking ahead, future research should explore the long-term impacts of personalized learning, investigate its effectiveness across various disciplines, and consider its emotional and psychological effects on learners. Additionally,

continued innovation in adaptive learning technologies and data-driven personalization holds great promise for creating more inclusive, engaging, and effective learning experiences.

Overall, this study reinforces the transformative potential of personalized learning pathways in MOOCs. By aligning educational content with individual student needs and goals, PLPs offer a powerful strategy for enhancing engagement, supporting academic success, and shaping the future of digital education in meaningful and impactful ways.

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