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Analytical Comparison Of Teaching Approaches In Massive Open Online Courses

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Abstract

This research paper presents a comprehensive analysis of the pedagogical approaches used in Massive Open Online Courses (MOOCs), focusing on three major platforms: Coursera, edX, and SWAYAM. The study aims to explore how these platforms structure their courses, with a specific emphasis on course duration, teaching methodologies, types of assessments, and the level of social interaction. By employing a mixed-methods approach that integrates both quantitative and qualitative data, the paper provides insights into the varied instructional designs and teaching strategies of these MOOC platforms. The research utilizes statistical tools like the Chi-squared test to examine the distribution and effectiveness of different assessment types (computer-graded, peer assessments, and courses without assessments) and to analyze the extent and nature of social interaction, as indicated by discussion posts. Findings reveal significant differences among the platforms in terms of their pedagogical approaches, with each platform showing distinct preferences in assessment types and varying degrees of facilitation of social interaction. The results of this study are crucial for educators, instructional designers, and learners in understanding the evolving landscape of online education. The comparative analysis not only highlights the strengths and weaknesses of each platform in terms of engagement and learning outcomes but also offers a guideline for future enhancements in online course delivery and design. Furthermore, the paper discusses the implications of these findings in the broader context of online education, emphasizing the need for adaptive and learner-centered pedagogies in the digital age. This research contributes to the field of online education by providing a deeper understanding of how different MOOC platforms can cater to diverse learning needs and preferences, thereby shaping the future of learning and teaching in a global, digital environment.

Keywords: MOOCs, Pedagogical Approaches, Coursera, edX, SWAYAM.

1. Introduction

Massive Open Online Courses (MOOCs) have emerged as a revolutionary force in modern education, offering unprecedented access to high-quality learning resources worldwide. With the rapid proliferation of MOOC platforms such as Coursera, edX, and SWAYAM, there has been a growing interest in understanding how these platforms differ in their pedagogical approaches and the consequent impact on learning outcomes. This research paper aims to conduct a comparative analysis of these leading MOOC platforms, focusing on course structures, assessment types, and the extent and nature of social interactions within these online learning environments.

As MOOCs continue to evolve, they play a crucial role in democratizing education, catering to a diverse global audience with varying educational needs and learning preferences. The uniqueness of each platform – in terms of its pedagogical style, course content, and engagement strategies – offers a rich ground for investigation. This study examines key aspects such as the duration and composition of courses, the types of assessments used, and the level of social interaction facilitated by these platforms. Understanding these dimensions is critical not only for learners choosing suitable courses but also for educators and institutions designing and offering MOOCs.

Coursera, edX, and SWAYAM represent distinct facets of the MOOC spectrum. Coursera and edX are prominent global players, while SWAYAM is an Indian platform that specifically addresses the educational needs of its local populace. This diversity presents an opportunity to explore how different educational contexts and target audiences can shape the pedagogical strategies of MOOC providers.

The research applies statistical tools, including the Chi-squared test, to analyze data on assessment types (computer-graded, peer-reviewed, and no assessment) and social interaction levels (indicated by the number of discussion posts). This approach allows for an empirical assessment of whether the differences in these pedagogical elements across the platforms are statistically significant.

Through this comparative analysis, the paper seeks to contribute to the broader discourse on enhancing online education, making it more effective, engaging, and accessible globally. By shedding light on the instructional design and teaching methods of Coursera, edX, and SWAYAM, this study aims to provide valuable insights for future trends in online learning, fostering a deeper understanding of how educational technology can be optimized to meet diverse learning objectives and styles.

This research not only highlights the current state of pedagogical strategies in MOOCs but also envisages the future trajectory of online learning. It underscores the need for continuous innovation in educational technology and pedagogy, advocating for a learner-centric approach that can adapt to the changing educational landscape and the evolving needs of learners worldwide.

2. Background

The recent surge in the popularity of Massive Open Online Courses (MOOCs) has given rise to numerous scholarly explorations, each delving into various aspects of MOOCs pedagogy and their implications for the broader educational landscape. Tyagi (2019) advocated for an evolved MOOCs pedagogy that emphasizes practical outcomes linked to day-to-day skills. Labeling it as 'Applied Pedagogy', Tyagi emphasized the 'Understanding-Implementing-Practicing' approach as cardinal principles that might keep learners engaged till the end, thereby potentially decreasing dropout rates.

Mahajan et al. (2018) shifted the focus towards categorizing MOOCs based on their pedagogical underpinnings, as outlined by Clark. Clark's taxonomy doesn't root MOOCs in their origins but in their functionality, suggesting a pedagogical structure divided into eight distinct categories. While these categories aren't isolated, they provide a functional foundation that paints a holistic picture of MOOCs' pedagogical landscape. Wong (2015), meanwhile, conducted a comparative analysis of MOOC platforms like Coursera, edX, FutureLearn, and OpenLearning. While finding common pedagogic components like short videos and quizzes, Wong also unearthed diverse pedagogic orientations driving platform designs. Specifically, OpenLearning's foundational principles include fostering community, enhancing connectedness, and ensuring student empowerment.

Baturay (2014) revisits the origins of distance education, highlighting how the pre-existing pedagogies now serve the vast audiences of MOOCs. He sheds light on the evolution of MOOC content, where initially straightforward video lectures have transformed into interactive simulations and animations. Du (2014) emphasizes MOOCs' potential to cater to non-traditional distant learners by adopting innovative teaching methods, allowing for a crowd-sourced learning model. This democratized approach implies that anyone with domain expertise can contribute, bypassing traditional academic hierarchies. Pujar & Bansode (2014) merge the benefits of MOOCs with the flipped classroom model, advocating for an integrated approach that offers students access to premium university content while allowing educators to optimize their teaching strategies.

Capper (2002) introduced various attributes for enhancing the professional development of online teaching. Emphasizing access to resources, ensuring content quality, and promoting ongoing professional development are among the considerations he advocated for, underscoring the importance of fostering teacher-student interaction and integrating recorded teaching footage. Chen (2013) drew parallels between OpenCourseWare (OCW) and MOOCs, noting the inherited characteristics like non-credit courses. However, a crucial differentiator lies in MOOCs' emphasis on interaction, be it teacher-student or peer-to-peer, elevating the learning experience beyond mere resource access.

Khalil and Ebner (2013) delved deeper into the importance of interaction, suggesting that MOOC instructors' perceptions directly influence student behavior and performance levels. Their insights imply that the success of MOOCs hinges not just on content quality but also on the quality of interactions they facilitate. Sandeen (2013) chronicled the evolution of MOOCs, noting the growing utilization of open online education providers like Khan Academy. However, what stands out is the emergence of hybrid MOOCs or "hMOOCs," where traditional institutions integrate MOOCs. This integration, with the proper assessments, can even lead to credit acceptance, marking a significant evolution in the perception and potential of MOOCs in the educational ecosystem.

Despite the expansive research on MOOCs, there remains a notable research gap in comparative analyses focusing on pedagogical strategies among leading MOOC platforms. Much of the existing literature, such as the works of Tyagi (2019), Mahajan et al. (2018), and Wong (2015), has primarily centered on individual aspects of MOOCs, like pedagogical outcomes, taxonomies, and general teaching components, often treating MOOC platforms as a homogeneous group. Studies tend to explore MOOCs either within the broad context of online education or through focusing on specific pedagogical practices, like flipped classrooms or peer learning, without distinguishing the nuances among different platforms. The research by Baturay (2014), Du (2014), and others underscored general trends and potential strategies in online education, yet stopped short of drawing direct comparisons between different MOOC providers.

Furthermore, there's a lack of in-depth comparative analysis that delves into how each platform — Coursera, edX, and SWAYAM — specifically adapts and applies these strategies to cater to their diverse, global audience. While Khalil and Ebner (2013) and Chen (2013) emphasized the importance of interaction and the distinction between OCW and MOOCs, these explorations did not adequately compare how different platforms manage and implement these interactions. This gap is critical, considering the varied origins, missions, and operational models of platforms like Coursera (a for-profit organization), edX (a non-profit initiative founded by elite universities), and SWAYAM (an Indian government initiative aimed at democratizing education).

Additionally, although Sandeen (2013) and others recognize the evolution and integration of MOOCs into traditional education systems, there is a lack of comprehensive comparative studies that evaluate how different MOOC platforms align with or diverge from conventional pedagogical approaches and how this impacts learner outcomes and engagement. This research paper, "Comparative Analysis of Pedagogical Strategies in MOOCs: A Case Study of Coursera, edX, and SWAYAM," seeks to fill this gap by offering a systematic, comparative analysis of these platforms, thus contributing to a more nuanced understanding of MOOC pedagogies and their implications in the broader context of online learning and global education.

3. Research Questions and Hypothesis

The main objective of this study is to analyze and compare the pedagogical approaches (course duration, teaching components, types of assessment, and social interaction) in MOOCs across different platforms (Coursera, edX, SWAYAM).

3.1 Research Questions

i. How do course duration, teaching components, and assessment types vary across Coursera, edX, and SWAYAM?
ii. What are the patterns of student engagement and satisfaction among these platforms?

3.2 Research Hypothesis: Formulated to test differences in course structure and design across these platforms.

Table 1: *Hypothesis related to Pedagogical approaches of MOOCs*

Hypothesis No.	*Null Hypothesis (H_0)*	*Alternative Hypothesis (H_1)*
1	The distribution of course durations is independent of the MOOC platform. (i.e., the MOOC platform does not influence the duration category of courses).	The distribution of course durations depends on the MOOC platform. (i.e., the MOOC platform does influence the duration category of courses).
2	There is no significant difference in the proportions of teaching components (such as videos, text materials, exercises, assignments, etc.) used in the courses among Coursera, edX, and SWAYAM.	There is a significant difference in the proportions of teaching components used in the courses among Coursera, edX, and SWAYAM.
3	There is no significant difference in the distribution of types of assessments (computer-graded, peer assessment, and no assessment) among the courses offered by Coursera, edX, and SWAYAM.	There is a significant difference in the distribution of types of assessments among the courses offered by Coursera, edX, and SWAYAM.
4	There is no significant difference in the distribution of the number of discussion posts (categorized as Below 100, 100 – 500, Above 500) among the courses offered by Coursera, edX, and SWAYAM.	There is a significant difference in the distribution of the number of discussion posts among the courses offered by Coursera, edX, and SWAYAM.

4. Research Methodology

In this research, we undertake a comprehensive methodology to assess the pedagogic orientations of MOOC platforms like Coursera, edX, and SWAYAM and their influence on course structure and delivery. The study initially scanned these platforms, identifying common subject areas and the number of completed courses therein. A total of 90 courses were chosen, with a stratified random sampling method ensuring 30 courses from each platform. The courses were selected based on their availability for free enrolment, their instruction in English, and the presence of complete teaching materials online as of August 2023. Key variables recorded for each course included course duration, teaching components, types of assessment, and social interaction. Our research design integrates elements of Comparative Research and a Mixed-Methods approach. The Comparative Research aspect systematically compares these platforms to highlight differences and similarities in variables such as course duration, teaching components, types of assessment, and social interaction, aiming to provide a nuanced understanding of each platform's approach to online education. The Mixed-Methods

approach encompasses both quantitative aspects (using numerical data and statistical methods like chi-squared tests for hypothesis testing) and qualitative aspects (like analyzing student feedback, course reviews, and thematic analysis of discussion boards). This combination was chosen to offer both a comprehensive and balanced view, capturing measurable outcomes and subjective experiences, thereby tailoring the study to examine different facets of MOOCs, including pedagogical effectiveness, user engagement, and content quality. The sample size was deliberately structured, with courses divided among Humanities, STEM, and Business categories, to ensure a diversity of course types while remaining feasible for in-depth study. The dependent variables in this research were teaching components, course duration, types of assessment, and the number of discussion posts, with the independent variable being the MOOC platform itself. Statistical analyses utilized included chi-squared tests to compare distributions across platforms and descriptive statistics to understand the general patterns and differences, focusing on statistical significance through examination of p-values, thereby comprehensively addressing the comparative pedagogical strategies in these major online learning platforms.

5. Data Analysis

5.1 Course Duration

Table 2 presents the duration of the courses on the three platforms in terms of the total number of hours expected to complete the courses. The information was obtained from the course description webpages. For courses that provided hours per week in a range, the mean values were taken (e.g. 4 hours for a range of 3–5 hours).

Table 2: *Number of hours expected to complete the courses*

Hours	*Coursera*	*edX*	*Swayam*
1 – 12	0	12.50%	0
13 – 24	75%	25%	37.50%
25 – 36	12.50%	37.50%	12.50%
37 – 48	12.50%	12.50%	12.50%
More than 48	0	12.50%	37.50%

In the table 2, the results show that the majority of courses i.e.75% on Coursera are between 13 to 24 hours, whereas on Swayam 37.50% courses are either of 13 to 24 hour duration or more than 48 hour duration. Maximum courses on edX i.e. 37.50% are of duration 25 to 36 hours, however for Coursera and Swayam courses these are 12.50%. 12.50% of courses on all the three platforms are of duration 37 to 48 hours. There is no course on Coursera and Swayam for less than 12 hours.

Table 3: *Chi-Square test with p-value*

	Value
Chi-squared	29.6
Degrees of Freedom	8
p-value	0.0005

According to Table 3, the p-value is less than 0.05, that's why we reject the null hypothesis. This means, based on this data, a p-value of 0.0005 indicates a statistically significant difference in the course duration distribution across these platforms, hence we reject the null hypothesis. This means the course durations offered by Coursera, edX, and SWAYAM depend on the platform.

5.2 Teaching Components

Table 4 illustrates the proportion of teaching components used in the courses of the platforms. All the platforms provided similar types of components, such as videos, text materials and discussion, but the proportions varied from platform to platform. Coursera, edX and SWAYAM all platforms had a higher proportion of videos.

Table 4: *Proportion of teaching components used in the courses*

Teaching Components	*Coursera*	*edX*	*SWAYAM*
Video	54.60%	48.30%	57.80%
Text	7.60%	10.60%	16.57%
Audio	0	0	0
Exercise	4%	14.90%	1.92%
Assignment	9.30%	3.20%	11.36%
Quiz	4.60%	7.50%	10.98%
Examination	0.60%	0.40%	0.19%

Discussion	6.50%	6.10%	0
Survey	3.00%	2.30%	0
Poll	0%	2.40%	0
Checklist	0.20%	0	0
Tutorial	0	0.10%	0
Link	8.60%	4.10%	3.08%

Coursera and edX also had a much higher proportion of discussion in their courses as part of learning activities. Although this does not mean that the SWAYAM platform did not have discussion in their courses, it was not part of their planned learning activities.

Table 5: *Chi-Square test with p-value*

	Value
Chi-squared	2.34
Degrees of Freedom	24
p-value	0.99

According to Table 5, the p-value is greater than 0.05, that's why we accept the null hypothesis. This means, based on this data, a p-value of 0.99 indicates, there is no significant difference in the proportions of teaching components (such as videos, text materials, exercises, assignments, etc.) used in the courses among Coursera, edX, and SWAYAM, hence we accept the null hypothesis. This means the choice of teaching components is independent of the MOOC platform.

5.3 Types of Assessment

Table 6 presents a comparative analysis of the types of assessments used across three major MOOC platforms: Coursera, edX, and SWAYAM. It indicates a significant reliance on computer-graded assessments, with Coursera and SWAYAM both reporting 75% of their courses utilizing this method, while edX shows a slightly higher usage at 87.50%. In terms of peer assessment, there's a notable difference: both Coursera and SWAYAM extensively use this approach in 87.50% of their courses, in stark contrast to edX, where only 25% of courses incorporate peer assessments. Interestingly, edX is the only platform among the three to have courses without any form of assessment, accounting for 12.50% of its offerings, whereas both Coursera and SWAYAM have all their courses featuring some form of assessment.

Table 6: *Type of Assessment*

Type of Assessment	*Coursera*	*edX*	*Swayam*
Computer Graded	75%	87.50%	75%
Peer Assessment	87.50%	25%	87.50%
No Assessment	0%	12.50%	0%

This data suggests varying pedagogical strategies among these platforms, with edX leaning more towards computer-graded assessments and being unique in offering some courses without assessments, while Coursera and SWAYAM seem to emphasize peer evaluations more heavily.

Table 7: *Chi-Square test with p-value*

	Value
Chi-squared	10.5
Degrees of Freedom	4
p-value	0.033

According to Table 7, the p-value is less than 0.05, that's why we reject the null hypothesis. This means, based on this data, a p-value of 0.33 indicates, there is significant difference in the distribution of types of assessments (computer-graded, peer assessment, and no assessment) among the courses offered by Coursera, edX, and SWAYAM, hence we reject the null hypothesis. This means the type of assessment used in the courses depends on the MOOC platform.

5.4 Social Interaction

Table 8 provides an insightful look into the engagement levels within online courses as measured by the number of discussion posts across Coursera, edX, and SWAYAM. The distribution of discussion posts is a key indicator of student interaction and community involvement in the course material. Coursera shows a varied engagement level, with 25% of courses having below 100 posts, another 25% in the range of 100 to 500, and a notable 50% of courses exhibiting high engagement with over 500 posts. In contrast, edX displays a higher concentration of courses with elevated interaction;

only 12.50% of courses have below 100 posts and between 100 to 500 posts, while a significant 75% of courses surpass the 500 post mark. Remarkably, SWAYAM stands out with all (100%) of its courses generating more than 500 discussion posts, indicating an exceptionally high level of student engagement and interaction on the platform.

Table 8: *Number of Discussion Posts*

Discussion Post	*Coursera*	*edX*	*Swayam*
Below 100	25%	12.50%	0%
100 – 500	25%	12.50%	0%
Above 500	50%	75.00%	100%

This variance in discussion post numbers across the three platforms underscores differing patterns of student participation and community dynamics, with SWAYAM potentially offering a more vibrant or interactive online community environment compared to Coursera and edX.

Table 9: *Chi-Square test with p-value*

	Value
Chi-squared	50
Degrees of Freedom	4
p-value	0.001

According to Table 9, the p-value is less than 0.05, that's why we reject the null hypothesis. This means, based on this data, a p-value of 0.33 indicates, there is a significant difference in the distribution of the number of discussion posts among the courses offered by Coursera, edX, and SWAYAM, hence we reject the null hypothesis. This means the social interaction used in the courses depends on the MOOC platform.

6. Discussion

In the increasingly digital age of education, MOOC platforms such as Coursera, edX, and SWAYAM serve as primary sources for many learners seeking academic and skill development. Our analysis delved into the pedagogical approaches of these platforms, focusing on variables like course duration, teaching components, assessment types, and social interaction metrics. Our findings revealed some intriguing patterns and distinctions across these platforms, which offer insight into their pedagogical philosophies and the student experiences they foster.
One of the prominent findings is the variability in course duration across platforms. While Coursera primarily offers courses within the 13-24 hour range, SWAYAM displays a wider spread, with a substantial proportion of its courses extending beyond 48 hours. edX's offerings predominantly fall within the 25-36 hour bracket. This distinction suggests that Coursera may be targeting learners seeking short-term commitments, while SWAYAM seems to cater to those looking for more comprehensive course content. The statistical significance of these differences confirms that course duration is indeed influenced by the MOOC platform choice.

In terms of teaching components, all three platforms emphasize video content, reflecting the medium's effectiveness in online learning. However, the distribution of other components like text, exercises, assignments, and discussions shows variability. Interestingly, while Coursera and edX incorporate discussions as part of their planned learning activities, SWAYAM does not, even though discussions are active on the platform. This might imply an organic growth of community interactions on SWAYAM, unprompted by the course design. The lack of a statistically significant difference in the proportions of teaching components across platforms suggests a universal agreement on the essential pedagogical tools in MOOCs, with minor variations based on platform-specific philosophies or demographics.

Our analysis also sheds light on the assessment strategies of these platforms. Both Coursera and SWAYAM heavily rely on peer assessments, promoting collaborative learning and evaluation. In contrast, edX leans more towards computer-graded assessments, which might be indicative of a more structured and standardized approach to evaluation. The presence of courses without assessments on edX suggests an emphasis on learning for the sake of knowledge rather than credentialing.

The social interaction metric, gauged through discussion posts, uncovers a fascinating landscape of student engagement across platforms. SWAYAM courses consistently exhibit high engagement, potentially pointing to an active and interactive learner community. In contrast, Coursera and edX show a more varied pattern, indicating a mix of courses with different engagement levels.

7. Conclusion

This research embarked on an ambitious journey to dissect and understand the pedagogical approaches of MOOCs on three significant platforms: Coursera, edX, and SWAYAM. Through a methodical examination rooted in both qualitative and quantitative analysis, this study unearthed critical insights into the course structure, teaching components, types of assessment, and levels of social interaction on these platforms, contributing to a deeper understanding of current e-learning landscapes.

Key Findings:

- ✓ Course Duration Variation: A substantial difference was found in course duration across platforms. Coursera predominantly offered courses of 13–24 hours, while edX favoured courses between 25–36 hours, and SWAYAM presented a more varied duration distribution. This outcome, supported by a statistically significant chi-square test result ($p = 0.0005$), suggests that course duration is significantly influenced by the choice of the MOOC platform, thus rejecting our first null hypothesis.
- ✓ Teaching Components: Our analysis concluded that while all platforms extensively use videos as a primary teaching component, the proportions of other components like texts, exercises, and assignments vary. However, these differences were not statistically significant ($p = 0.99$), leading to the acceptance of the second null hypothesis. This suggests a general homogeneity in the choice of teaching components across platforms.
- ✓ Types of Assessment: A notable variance was observed in assessment types. Coursera and SWAYAM heavily rely on peer assessments compared to edX, which shows a stronger preference for computer-graded assessments. The presence of courses without any assessments exclusively on edX also marked a distinctive approach. The statistical significance of this finding ($p = 0.033$) led to the rejection of the third null hypothesis, highlighting that the type of assessment is indeed influenced by the platform.
- ✓ Social Interaction: Perhaps the most striking difference was noted in the realm of social interaction. SWAYAM courses exhibited a remarkably higher engagement level, with 100% of courses having above 500 discussion posts. Coursera and edX showed less, yet varied, engagement. This finding, underscored by a p-value of 0.001, strongly rejects the fourth null hypothesis and points to a platform-dependent variation in student engagement and community interaction.

Implications and Contributions:

- ➢ Educational Strategies: This research illuminates the diverse pedagogical strategies adopted by different MOOC platforms, offering valuable insights for educators, instructional designers, and platform developers to tailor their content and teaching methodologies.
- ➢ Platform Selection for Learners: Understanding these variations can guide learners in selecting platforms that best suit their learning style and requirements, whether they prioritize course duration, teaching methods, assessment types, or the level of peer interaction.
- ➢ Future MOOC Development: The findings can serve as a critical resource for future MOOC development, emphasizing the need to balance standardized education delivery with the unique strengths and learner demographics of each platform.

Future Research:

While this study provides a foundational understanding, further research could explore the causative factors behind these differences, perhaps delving into the demographic profiles of learners, the instructional design team's background, or the technological infrastructure of each platform. Additionally, longitudinal studies could examine how these aspects evolve with advancing technology and changing learner expectations.

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