

Role of MOOCs in Developing Critical Thinking Skills among Secondary School Students: A Systematic Review

Leju Vidosh¹,

Research Scholar, Pillai College of Education and
Research, University of Mumbai¹

Dr. Reni Francis²,

Research Guide, Pillai College of Education and
Research, University of Mumbai²

Abstract. Massive Open Online Courses (MOOCs) have emerged as an important component of digital education because they provide learners with flexible access to structured learning resources, multimedia content, discussion activities, formative assessment and opportunities for self-directed learning. In India, the development of SWAYAM and the broader digital-education ecosystem has increased the policy relevance of MOOCs, although much of the empirical literature has focused on higher education rather than secondary schooling. This systematic review examines the potential and documented role of MOOCs in developing critical thinking skills among secondary school students, with particular attention to Indian educational contexts and literature published between 2020 and 2025. The review adopts a PRISMA-informed systematic literature-review approach and synthesises evidence concerning digital learning, MOOCs, critical thinking, learner autonomy, interaction, problem solving and reflective learning. The reviewed Indian literature indicates that MOOCs can support critical thinking when courses incorporate inquiry-oriented activities, problem solving, discussion, reflection, formative assessment and opportunities for learners to evaluate information rather than merely consume instructional content. However, the evidence specific to secondary school students remains limited compared with evidence from higher education. Major barriers include unequal digital access, teacher preparedness, learner motivation, language issues, limited interaction and the risk of passive video-based learning. The review concludes that MOOCs should be regarded not as a replacement for teachers but as a technology-supported pedagogical environment that

can strengthen critical thinking when appropriately designed and integrated with classroom instruction. The paper proposes a MOOC-based critical-thinking framework for Indian secondary education and identifies priorities for experimental, longitudinal and school-level research.

keywords: MOOCs, critical thinking, secondary education, SWAYAM, digital learning, school education, India, systematic review, online learning.

I. Introduction

The development of critical thinking has become an increasingly important objective of contemporary school education. Critical thinking involves the ability to analyse information, question assumptions, evaluate evidence, compare alternative explanations, draw reasoned conclusions and reflect on one's own reasoning. In the context of secondary education, these capabilities are particularly important because students increasingly encounter large quantities of information through digital media, social platforms and online learning environments. Dogra (2020) argues that critical thinking should be treated as an essential educational capability and that students can develop it through appropriately designed learning experiences.

The increasing digitalisation of education has created new possibilities for developing these capabilities. MOOCs provide learners with online courses that can incorporate video lectures, readings, quizzes, assignments, discussion forums, peer interaction and other forms of digital learning activity. In India, the SWAYAM platform has become an important national mechanism for delivering MOOCs. Jha and Harichandan (2022) describe SWAYAM as an Indian MOOC ecosystem providing access to educational materials developed by teachers and institutions across the country, using a structured four-quadrant model of course delivery.

The COVID-19 pandemic further accelerated the adoption of online learning in India and increased attention to digital platforms as supplementary and alternative learning environments. Bast (2021), in an empirical study of Indian students, found considerable variation in perceptions of online learning according to factors such as location, technology receptiveness, socioeconomic background and access to devices. The findings are relevant to MOOCs because access and learner readiness are important preconditions for effective online learning.

However, access to online content does not automatically produce critical thinking. A learner may watch instructional videos and complete objective quizzes without analysing, evaluating or applying information. Consequently, the educational value of MOOCs depends substantially upon course design and the extent to which learning activities require higher-order cognitive engagement. This distinction provides the central rationale for the present review.

The specific focus on secondary school students is also important. Much of the Indian MOOC literature has concentrated on universities, professional education and teacher education. For example, research examining SWAYAM has considered its implementation and effectiveness primarily within higher education, including the UGC policy permitting credit-based MOOCs in higher educational institutions (Bordoloi et al., 2023). This creates a need to examine whether and how the pedagogical principles underlying MOOCs can contribute to critical thinking at the secondary-school level.

II. Conceptual Background

1. MOOCs and Digital Learning

MOOCs are large-scale online courses designed to provide structured learning opportunities to potentially large numbers of learners. Their defining characteristics include online accessibility, organised learning materials, learner flexibility and technology-mediated assessment and interaction. In India, SWAYAM represents a major national initiative for developing and distributing MOOCs.

Jha and Harichandan (2022) explain that SWAYAM courses follow a four-quadrant approach involving video-based learning, downloadable/reading materials, self-assessment and discussion or interaction components. This structure has considerable pedagogical relevance because critical thinking requires more than passive information exposure. Learners need opportunities to question, analyse, apply, discuss and reflect.

Indian policy developments have also progressively institutionalised MOOCs within the country's digital learning ecosystem. UGC records show continued SWAYAM course offerings during 2020–2022, demonstrating the institutionalisation of MOOCs within Indian higher education and digital-learning policy. Although these initiatives have primarily targeted higher education, the underlying technology and pedagogical infrastructure has implications for school education.

2. Critical Thinking in Secondary Education

Critical thinking in secondary education involves higher-order cognitive processes through which students interpret information, analyse relationships, evaluate claims, infer conclusions and justify decisions. Dogra (2020) emphasises that critical thinking is not simply an innate characteristic but a skill that can be developed through appropriate educational strategies.

Indian educational scholarship also increasingly connects critical thinking with learner autonomy, inquiry and meaningful classroom participation. Bajaj (2021) argues that active learning environments can enable students to connect learning with their experiences, reflect on their understanding and apply knowledge to practical problems. Such processes closely correspond with the pedagogical mechanisms through which well-designed MOOCs may support critical thinking.

Mishra and Sharma (2025) similarly identify critical thinking as an important life and problem-solving skill for students and emphasise questioning, analysis, open-mindedness and solution-oriented thinking as central characteristics.

III. Review Methodology

1. Research Design

The study adopted a systematic literature-review design informed by the PRISMA 2020 principles. The purpose was to identify, examine and synthesise literature published between 2020 and 2025 concerning MOOCs, online learning, critical thinking and secondary or school education, with particular emphasis on evidence generated in India.

The review was designed around four research questions. The first question was: What evidence exists regarding the relationship between MOOCs or structured online learning and critical-thinking development? The second was: Which pedagogical features of MOOCs appear most relevant to critical-thinking development? The third was: What barriers limit the effectiveness of MOOCs for secondary school students in India? The fourth was: What research gaps remain concerning MOOC-based critical-thinking development at the secondary level?

2. Search Strategy

The literature search focused on combinations of the terms MOOCs, Massive Open Online Courses, SWAYAM, critical thinking, secondary school students, school education, digital learning, online learning, India, student engagement, problem solving and higher-order thinking. Searches were conducted across scholarly and institutional sources, including Indian educational journals, NCERT publications, UGC/SWAYAM materials and relevant academic databases.

The publication period was restricted primarily to 2020–2025. Indian studies were prioritised because the purpose was to develop an India-specific interpretation of the role of MOOCs in secondary education.

3. Inclusion and Exclusion Criteria

Studies were included when they were published between 2020 and 2025 and addressed at least one of the following: MOOCs, SWAYAM, online learning, digital learning, critical thinking, higher-order thinking, secondary education, school students or Indian educational contexts. Relevant Indian policy and institutional publications were also considered when they provided evidence concerning MOOC implementation or pedagogical design.

Studies were excluded when they were unrelated to education, concerned only technical aspects of online platforms, or contained no meaningful connection with learning, critical thinking or student development. International evidence was used only where it

assisted conceptual interpretation; the principal empirical discussion remained focused on Indian evidence.

4. Evidence Base

The review revealed an important methodological characteristic of the literature: direct empirical research linking MOOCs specifically to critical-thinking development among Indian secondary school students is comparatively limited. The evidence base therefore includes three interconnected categories: Indian research on critical thinking in school education, Indian research on MOOCs and digital learning, and Indian research examining online learning conditions and learner readiness.

This limitation itself constitutes an important finding of the review rather than a weakness to be concealed.

IV. Findings and Synthesis

1. MOOCs Can Provide Conditions for Critical-Thinking Development

The reviewed literature suggests that MOOCs can provide several conditions conducive to critical thinking. First, MOOCs can expose students to multiple forms of information through videos, readings, examples and supplementary materials. Second, asynchronous learning can provide students with additional time to review and reconsider information. Third, discussion activities can expose learners to alternative interpretations. Fourth, quizzes and assignments can provide opportunities for application and evaluation.

The four-quadrant SWAYAM model is particularly relevant because it does not conceptualise online learning exclusively as video consumption. Jha and Harichandan (2022) identify videos, reading resources, self-assessment and interaction as components of the SWAYAM course structure. When these components are designed around higher-order questions, they can create a learning sequence from information acquisition → analysis → application → reflection.

However, merely possessing these features does not guarantee critical-thinking development. The activities must require students to interpret evidence, compare alternatives, explain reasoning and defend conclusions.

2. Inquiry and Questioning

Inquiry is one of the strongest conceptual mechanisms linking MOOCs with critical thinking. Students develop critical thinking when they are required to ask questions rather than simply receive answers.

Dogra (2020) emphasises the importance of questioning assumptions and developing an objective and questioning perspective among school students. Therefore, MOOC content intended for secondary students should contain open-ended questions, problem situations and opportunities for students to challenge explanations.

A conventional video followed by a recall-based multiple-choice quiz may produce knowledge acquisition but relatively limited critical reasoning. By contrast, a video followed by an evidence-evaluation task, discussion question or problem-based assignment is more likely to activate higher-order cognition.

3. Problem Solving and Application

Problem solving provides another mechanism through which MOOCs can support critical thinking. Secondary students need opportunities to apply concepts to unfamiliar situations rather than merely reproduce information.

Bajaj (2021) highlights the value of allowing learners to connect knowledge with experience and apply understanding to practical problems. This principle can be transferred to MOOC design through case studies, simulations, scenario-based questions and project assignments.

For example, a science MOOC could present students with an environmental problem and ask them to identify evidence, evaluate alternative explanations and propose a solution. Such activities transform the MOOC from an information-delivery mechanism into a cognitive problem-solving environment.

4. Reflection and Learner Autonomy

Critical thinking also requires reflection. Students need opportunities to examine their own assumptions, identify weaknesses in reasoning and reconsider conclusions.

The flexibility of MOOCs can potentially support this process because students can revisit instructional materials and complete learning activities at their own pace. However, learner autonomy also introduces risks. Students with weak self-regulation may not engage deeply with optional materials or reflective activities.

Consequently, MOOC-based learning for secondary students should provide structured scaffolding rather than assuming that all students possess high levels of self-directed learning ability.

5. Discussion and Collaborative Learning

Interaction is another important factor. Critical thinking develops through exposure to alternative viewpoints and through the requirement to justify one's position.

The SWAYAM four-quadrant framework includes interaction as part of the learning architecture (Jha & Harichandan, 2022). This creates an opportunity for discussion-based critical thinking. Students can be asked to post an argument, respond to a peer's position, identify strengths and weaknesses in competing explanations and revise their own conclusions.

For secondary school students, however, teacher moderation is likely to be especially important. Unmoderated online discussion may become superficial or dominated by a small number of participants.

6. Technology Access as a Critical Condition

One of the most important findings concerns digital inequality. Bast (2021) demonstrated that Indian students' perceptions of online learning varied according to location, socioeconomic conditions, technology receptiveness and access to electronic devices. Urban students showed greater receptiveness to online learning than rural students.

This finding has direct implications for MOOCs and secondary education. A pedagogically excellent MOOC cannot improve critical thinking if students cannot consistently access the platform, videos or interactive activities.

Therefore, MOOC-based critical-thinking development should be understood as a function of both pedagogical quality and digital accessibility.

7. Teacher Mediation Remains Important

The evidence does not support the assumption that MOOCs can replace teachers in developing critical thinking. Instead, MOOCs are better conceptualised as supplementary learning environments.

Teachers can introduce MOOC materials, explain difficult concepts, facilitate discussion, evaluate student reasoning and connect online activities with classroom learning. This is particularly important at the secondary level, where students may require greater scaffolding than university learners.

The growing availability of teacher-oriented MOOCs also indicates the importance of teacher preparation. Research on Indian teacher-education MOOCs shows that SWAYAM contains substantial course provision aimed at developing teachers' pedagogical and technical competencies.

V. Thematic Synthesis of the Literature

Theme	Evidence from Indian Literature	Relevance to Critical Thinking
Digital access	Online-learning experiences vary according to device access, location and socioeconomic conditions (Bast, 2021)	Determines whether students can participate consistently
Inquiry	Critical thinking develops through questioning and challenging assumptions (Dogra, 2020)	Encourages analysis and evaluation

Active learning	Learner participation, experience and reflection support deeper learning (Bajaj, 2021)	Moves students beyond passive information reception
MOOC structure	SWAYAM uses video, reading, assessment and interaction components (Jha & Harichandan, 2022)	Creates multiple opportunities for higher-order learning
Teacher preparation	Indian MOOCs include courses supporting teacher pedagogical development	Strengthens teacher-mediated critical-thinking instruction
Learner autonomy	Online learning provides flexibility and self-directed opportunities	Supports independent analysis and reflection
Assessment	Formative assessment can be used to promote deeper learning and reflection	Allows evaluation and feedback on reasoning
Policy support	SWAYAM has received sustained institutional support in India	Provides infrastructure for large-scale digital learning

VI. Discussion

The central finding of this systematic review is that MOOCs have substantial potential, but the available Indian evidence does not yet justify a strong claim that MOOCs independently cause improved critical-thinking skills among secondary school students.

This distinction is important for academic rigour. The evidence demonstrates that MOOCs can provide pedagogical conditions associated with critical thinking, but direct causal evidence involving Indian secondary students remains insufficient.

The strongest mechanism appears to be active cognitive engagement. When students merely watch videos and answer recall questions, the learning experience may remain predominantly transmissive. When students analyse cases, evaluate evidence, discuss competing interpretations, solve problems and reflect on their conclusions, the same digital platform can become a higher-order learning environment.

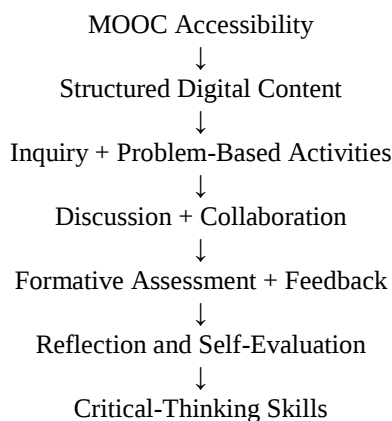
This interpretation is consistent with Dogra's (2020) argument that critical thinking can be cultivated through appropriate educational strategies. It is also compatible with Bajaj's (2021) emphasis on active participation, experience, reflection and application.

The Indian MOOC ecosystem provides an institutional foundation for this transformation. Jha and Harichandan (2022) demonstrate the breadth of SWAYAM's MOOC structure and its four-quadrant model. However, the pedagogical design of individual courses remains decisive.

The review also highlights a significant tension between scale and interaction. MOOCs are designed for large numbers of learners, but critical-thinking development often benefits from personalised feedback, dialogue and teacher guidance. This suggests that secondary-school MOOCs may be more effective when integrated into blended learning models rather than used as completely autonomous courses.

VII. Proposed MOOC-Based Critical-Thinking Framework

The evidence synthesised in this review supports the following conceptual framework:



The framework is moderated by teacher facilitation, digital access, learner motivation, language accessibility and digital literacy.

In this model, MOOCs are not treated as the direct cause of critical thinking. Rather, MOOCs provide a digital learning environment in which specific pedagogical processes can stimulate critical thinking.

VIII. Research Gaps

The first major gap is the population gap. Indian MOOC research has concentrated substantially on higher education, while comparatively little empirical research has examined secondary school students. The Indian literature on SWAYAM and credit-based MOOCs illustrates this higher-education orientation (Bordoloi et al., 2023).

The second gap is the outcome gap. Existing studies frequently examine access, acceptance, awareness, satisfaction or academic participation rather than directly measuring critical-thinking development.

The third gap is the methodological gap. There is a need for experimental and quasi-experimental studies comparing MOOC-supported instruction with conventional classroom instruction using validated critical-thinking measures.

The fourth gap concerns longitudinal evidence. Critical thinking is a developmental capability, yet much online-learning research relies on short-term surveys. Longitudinal research could establish whether repeated engagement with inquiry-oriented MOOCs produces sustained improvements.

The fifth gap concerns the digital-divide mechanism. Bast (2021) demonstrates that online-learning perceptions differ according to learner and contextual characteristics. Future studies should examine whether unequal digital access produces unequal critical-thinking benefits.

The sixth gap concerns teacher mediation. More research is needed to determine whether teacher-supported MOOC implementation produces stronger critical-thinking outcomes than independent MOOC participation.

The seventh gap concerns Indian-language content. Secondary-school learners in India operate in multilingual environments. Research should examine whether MOOCs delivered in regional languages or bilingual formats produce stronger engagement and critical-thinking outcomes than English-only courses.

Implications for Secondary Education

The review has several implications for Indian secondary education. First, MOOCs should not be implemented simply as repositories of video lectures. Their design should deliberately incorporate inquiry, problem solving, argumentation, discussion and reflection.

- Second, teachers should function as facilitators of MOOC-supported learning. The teacher can select appropriate MOOC modules, provide contextual explanations, create classroom discussion around MOOC content and assess the quality of students' reasoning.
- Third, assessment should move beyond recall. MCQs can be supplemented by case analysis, reflective writing, evidence evaluation, project work and open-ended problem solving.
- Fourth, schools should address digital-access inequalities before expecting MOOCs to produce equivalent benefits for all students.
- Finally, MOOC content should be aligned with secondary-school curriculum objectives rather than treated as an independent parallel curriculum.

IX. Conclusion

This systematic review examined the role of MOOCs in developing critical-thinking skills among secondary school students, with particular emphasis on Indian evidence

published between 2020 and 2025. The review indicates that MOOCs possess considerable potential to support critical thinking because they can provide flexible access to diverse learning resources, inquiry activities, assessments, interaction and opportunities for independent learning.

However, the effectiveness of MOOCs depends substantially on how they are designed and implemented. Passive video consumption is unlikely to produce substantial development of critical thinking. In contrast, MOOCs incorporating inquiry, problem solving, discussion, evidence evaluation, formative assessment, reflection and teacher facilitation can provide a stronger environment for higher-order cognitive development.

The Indian evidence also demonstrates that digital access cannot be separated from educational effectiveness. Differences in device access, location, socioeconomic conditions and technology readiness may influence participation in online learning (Bast, 2021).

The principal conclusion is therefore that MOOCs should be positioned as technology-enabled pedagogical environments rather than stand-alone substitutes for teachers. For secondary education, the most promising model is likely to be a blended approach in which MOOC resources are integrated with teacher-guided inquiry, classroom discussion and reflective assessment.

Most importantly, there remains a clear empirical need for Indian studies that directly test whether MOOC-supported instruction improves critical-thinking scores among secondary school students. Future research should employ experimental or quasi-experimental designs, validated critical-thinking instruments, longitudinal measurement and comparisons across urban and rural schools. Such evidence would enable policymakers and educators to move beyond assumptions about the value of MOOCs and establish their actual contribution to higher-order learning.

References

1. Bajaj, A. (2021). Activity-based learning in primary classrooms through the lens of philosophical assumptions. *Journal of Indian Education*, 47(2), 79–89. National Council of Educational Research and Training. (NCERT eJournals)
2. Bast, F. (2021). Perception of online learning among students from India set against the pandemic. *Frontiers in Education*, 6, 705013. (Frontiers)
3. Bordoloi, R., Das, P., & Das, K. (2023). Program inclusive, credit-based SWAYAM MOOCs in higher educational institutions of India. *International Journal of Educational Development*, 97, 102727. (ScienceDirect)
4. Dogra, B. (2020). Empowering school students through developing critical thinking skills. *Journal of Indian Education*, 46(2), 36–44. (NCERT eJournals)
5. Jha, J., & Harichandan, D. (2022). MOOCs in India and SWAYAM: An overview. *Indian Journal of Educational Technology*, 4(2), 266–277. (Indian Journal of Educational Technology)

6. Mishra, J., & Sharma, M. P. (2025). Critical thinking skill for students: For better today and sustainable future. *Educational Trend*, 1(1), 46–50. National Council of Educational Research and Training. (NCERT eJournals)
7. Sri, V., Divya, & Pradhan, D. K. (2025). Awareness of MOOCs among secondary-level teacher trainees: A cross-sectional study from India. *Journal of Education, Society and Behavioural Science*, 38(4), 221–231. (ResearchGate)
8. University Grants Commission. (2020–2022). SWAYAM course-related notifications and academic initiatives. Government of India. (UGC)