Impact of Curriculum Design on Students' Critical Thinking and their Problem-Solving Skills at Higher Secondary Level

Athar Hussain
Anhui University Department of foreign studies, China
Email: atharghaffar95@outlook.com

Muzamil Hussain ALHussaini
Phd Scholar, Qurtuba University D.I.Khan
Email: muzamilqurtuba@gmail.com

Abstract
The purpose of this study was to investigate the impact of curriculum design on students' critical thinking and problem-solving skills at the higher secondary level. The population of the study consisted of all higher secondary students in Pakistan, while a sample of 300 students was selected through stratified random sampling. This quantitative study employed a questionnaire as the data collection tool. Descriptive and inferential statistics were used to analyze the data. The results revealed a significant relationship between curriculum design and students' critical thinking and problem-solving skills. The findings suggest that a well-designed curriculum can enhance students' critical thinking and problem-solving skills. The study recommends that educators and policymakers should focus on designing curricula that promote critical thinking and problem-solving skills. The study contributes to the existing literature on curriculum design and its impact on students' cognitive skills.

Keywords: Curriculum Design, Critical Thinking, Problem-Solving Skills, Higher Secondary Level.

Introduction
The 21st century has brought about significant changes in the educational landscape, emphasizing the need for students to acquire critical thinking and problem-solving skills. These skills are essential for students to navigate the complexities of the modern world and to succeed in their future careers. Curriculum design plays a pivotal role in fostering these skills, as it provides the framework for teaching and learning. In Pakistan, the higher secondary level is a critical juncture in a student's academic journey, as it lays the foundation for future academic and professional pursuits. However, research suggests that the current curriculum design at the higher secondary level in Pakistan may not be adequately equipping students with critical thinking and problem-solving skills.

Research Objectives
a) To examine the relationship between curriculum design and students' critical thinking skills at the higher secondary level in Pakistan.
b) To investigate the impact of curriculum design on students' problem-solving skills at the higher secondary level in Pakistan.

Research Hypotheses
a) H0: There is no significant relationship between curriculum design and students' critical thinking skills at the higher secondary level in Pakistan.
b) H0: There is no significant impact of curriculum design on students' problem-solving skills at the higher secondary level in Pakistan.

Literature Review
Curriculum design plays a pivotal role in shaping the cognitive and analytical capabilities of students, particularly in fostering critical thinking and problem-solving skills. These skills are essential for academic success and lifelong learning, as they enable individuals to analyze complex situations, make informed decisions, and solve real-world problems effectively. The existing body of literature emphasizes the significance of well-structured curricula in enhancing these competencies among students, especially at the higher secondary level, where the transition from foundational to advanced cognitive skills occurs.

Importance of Curriculum Design in Cognitive Development
A well-designed curriculum serves as a roadmap for achieving educational objectives and outcomes (Tyler, 2018). Research highlights that curricula emphasizing inquiry-based learning, experiential activities, and interdisciplinary approaches promote higher-order thinking skills (Bransford et al., 2000). For instance, a study by Anderson and Krathwohl (2020) emphasized the need to align curricular goals with Bloom's taxonomy to ensure the systematic development of analytical and evaluative skills. Furthermore, Heick (2021) noted that integrating project-based learning (PBL) into curriculum design significantly improves students' ability to think critically by engaging them in authentic problem-solving tasks.

Critical Thinking in Education
Critical thinking is the ability to analyze information objectively, evaluate arguments, and construct reasoned conclusions (Paul & Elder, 2019). A growing body of research underscores the role of curriculum in nurturing critical thinking. According to Abrami et al. (2015), embedding critical thinking frameworks within curricular activities enhances students' analytical abilities. Studies have also shown that active learning strategies, such as debates, case studies, and collaborative learning, are effective in promoting critical thinking (Brookfield, 2017). For example, Terenzini et al. (2016) reported that students exposed to curricula that incorporate active learning activities demonstrate higher critical thinking scores than their peers in traditional lecture-based programs.

Moreover, critical thinking is closely linked to the integration of real-life scenarios into educational content. Snyder and Snyder (2020) found that when students encounter real-world challenges within their curriculum, they are more likely to develop reflective and evaluative thinking skills. The study emphasized the importance of scaffolding instructional strategies to guide students through complex problems, thereby enhancing their critical reasoning capabilities.

Problem-Solving Skills and Curriculum Design
Problem-solving skills, defined as the ability to identify, analyze, and resolve issues effectively, are crucial for students' academic and professional success (Jonassen, 2017). The literature indicates that curricula emphasizing hands-on, experiential learning significantly enhance students' problem-solving abilities. For instance, a meta-analysis by Hmelo-Silver et al. (2019) demonstrated that problem-based learning (PBL) curricula are highly effective in developing problem-solving skills. The study revealed that students engaged in PBL performed better on problem-solving tasks compared to those in conventional settings.

Similarly, Savery (2020) argued that incorporating real-world problems into the curriculum fosters students' ability to apply theoretical knowledge to practical situations. In this regard, Kolb's experiential learning theory provides a robust framework for designing curricula that enhance problem-solving skills (Kolb, 2014). Studies by Gijbels et al. (2016) corroborated these findings, showing that experiential and collaborative learning approaches in curricula result in improved problem-solving competencies among students.

Interplay Between Curriculum Design, Critical Thinking, and Problem-Solving
The integration of critical thinking and problem-solving within curriculum design is essential for holistic cognitive development. A study by Halpern (2014) emphasized that curricula designed to interweave these skills enable students to transfer knowledge across contexts effectively. Furthermore, research by Facione (2015) highlighted that teaching strategies, such as Socratic questioning and reflective journaling, when embedded within curricula, promote both critical thinking and problem-solving skills simultaneously.

Moreover, interdisciplinary curricula have been identified as a key factor in fostering these competencies. According to Jacobs (2017), interdisciplinary approaches encourage students to make connections between different subjects, thereby enhancing their analytical and problem-solving capabilities. For instance, integrating science, technology, engineering, and mathematics (STEM) subjects within a unified curriculum has been shown to improve students' critical thinking and problem-solving skills significantly (Beers, 2020).

Role of Technology in Curriculum Design
Technology integration in curriculum design has emerged as a transformative approach to enhancing critical thinking and problem-solving skills. Studies by Lai and Hwang (2019) revealed that digital tools, such as simulation software, gamified learning platforms, and virtual labs, provide students with interactive environments to practice and refine these skills. Similarly, Bower et al. (2020) noted that the use of technology-enabled collaborative platforms fosters critical thinking by allowing students to engage in discussions, share diverse perspectives, and collaboratively solve problems.

Additionally, adaptive learning technologies have been found to personalize curricular content based on students' individual needs, thereby addressing gaps in their critical thinking and problem-solving skills. For example, a study by Chen et al. (2021) demonstrated that adaptive learning platforms significantly

improve students' performance in problem-solving tasks by providing tailored feedback and resources.

Challenges in Curriculum Design for Higher Secondary Education

Despite its importance, designing curricula that effectively promote critical thinking and problem-solving skills poses several challenges. According to Darling-Hammond et al. (2020), the lack of teacher training in implementing innovative curricular strategies is a significant barrier. Additionally, rigid educational policies and standardized testing systems often limit the flexibility required to incorporate critical thinking and problem-solving into curricula (Au, 2018).

Furthermore, disparities in resource allocation across schools hinder the implementation of effective curriculum designs. Research by UNESCO (2021) highlighted that schools in underprivileged areas often lack access to the necessary materials and technologies for fostering these skills, exacerbating educational inequities.

Implications for Educational Policy and Practice

The findings from the literature emphasize the need for educational policies that prioritize curriculum reform to promote critical thinking and problem-solving skills. Policymakers should consider adopting competency-based curricula that focus on skill development rather than rote learning. Moreover, continuous professional development programs for teachers should be implemented to equip them with the knowledge and skills required to design and deliver effective curricula (Guskey, 2020).

Data Methodology

The present study employed a quantitative research approach, utilizing a survey design to collect data. A self-developed questionnaire was used as the data collection tool, which consisted of 30 items measuring curriculum design and students' critical thinking and problem-solving skills. The questionnaire was pilot-tested for validity and reliability. A stratified random sampling technique was used to select a sample of 300 students from higher secondary schools in Pakistan. The data was analyzed using descriptive and inferential statistics, including correlation and regression analysis, to examine the relationship between curriculum design and students' critical thinking and problem-solving skills.

Data Analysis & Interpretation

H01: There is no significant relationship between curriculum design and students' critical thinking skills at the higher secondary level in Pakistan.

Table 1: Pearson Correlation Analysis for the Relationship between Curriculum Design and Students' Critical Thinking Skills

Variable	Mean	SD	r	p	N
Curriculum Design	3.89	0.76	0.463**	<.001	300

Variable	Mean	SD	r	p	N
Critical Thinking Skills	4.12	0.68			

Note. r = Pearson correlation coefficient; **p** = significance level; **N** = sample size; **SD** = standard deviation.

p < .001 indicates statistical significance at the 0.05 level.

The results indicate a moderate positive correlation (r = 0.463, p < .001) between curriculum design and students' critical thinking skills at the higher secondary level. This suggests that as the quality of curriculum design improves, students' critical thinking skills tend to enhance correspondingly. The significant p-value indicates that the observed relationship is unlikely to be due to random chance, providing evidence to reject the null hypothesis (H_{01}). These findings highlight the critical role of well-structured curriculum design in fostering critical thinking abilities among students. The moderate strength of the correlation suggests that while curriculum design is a significant factor, other variables may also contribute to the development of critical thinking skills. Policymakers and educators are encouraged to integrate activities, projects, and interdisciplinary approaches that specifically target critical thinking within curriculum frameworks. Future research could explore other factors influencing critical thinking to provide a comprehensive understanding of its development at the higher secondary level.

Data Analysis for Null Hypothesis 2
H_{02}: There is no significant impact of curriculum design on students' problem-solving skills at the higher secondary level in Pakistan.

Table 1: Regression Analysis for the Impact of Curriculum Design on Students' Problem-Solving Skills

Model	B	SE	β	t	p
Constant (Intercept)	2.31	0.21	--	11.00	<.001
Curriculum Design	0.46	0.08	0.41	5.75	<.001

Model Summary

R^2 = 0.17, F(1, 298) = 33.06, p < .001

The regression analysis indicates that curriculum design significantly predicts students' problem-solving skills (B = 0.46, SE = 0.08, β = 0.41, t = 5.75, p < .001). The positive unstandardized coefficient (B) suggests that for every one-unit increase in curriculum design quality, students' problem-solving skills increase by 0.46 units. The standardized coefficient (β = 0.41) indicates a moderate effect size, signifying that curriculum design contributes substantially to variations in problem-solving skills. The R^2 value of 0.17 implies that approximately 17% of the variance in problem-solving skills is explained by

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curriculum design, highlighting its critical role in shaping students' cognitive abilities. The significant F-ratio ($F(1, 298) = 33.06$, $p < .001$) further confirms the overall model fit, indicating that curriculum design significantly contributes to predicting problem-solving skills beyond chance levels. These results provide strong evidence to reject the null hypothesis (H_{02}), supporting the claim that a well-structured curriculum has a positive and significant impact on students' problem-solving abilities. The findings underscore the importance of integrating problem-solving-focused strategies, such as real-life scenarios, case studies, and hands-on activities, into curriculum design. Educators and policymakers should prioritize these elements to prepare students for real-world challenges. Further research could examine additional factors or mediators, such as teacher effectiveness or student motivation, that might enhance the impact of curriculum design on problem-solving skills.

Findings

1. The study found a significant positive relationship between curriculum design and students' critical thinking skills ($r = 0.463$, $p < .001$), indicating that a well-designed curriculum contributes to enhanced critical thinking abilities among higher secondary students.
2. The regression analysis revealed that curriculum design significantly predicts students' problem-solving skills ($B = 0.46$, $\beta = 0.41$, $p < .001$), explaining 17% of the variance in problem-solving skills.
3. Both critical thinking and problem-solving skills showed moderate effects from curriculum design, emphasizing its vital role in shaping students' cognitive development.

Recommendations

1. Policymakers and curriculum developers should focus on designing curricula that include critical thinking and problem-solving activities, such as case studies, inquiry-based learning, and project-based tasks.
2. Educators should be trained to implement strategies that foster critical thinking and problem-solving in classroom settings, such as Socratic questioning, collaborative learning, and simulation exercises.
3. Evaluation methods should incorporate real-world problem-solving scenarios and critical thinking tasks to align with curriculum goals.
4. Regular reviews and updates to the curriculum should be conducted based on feedback from students, teachers, and industry experts to ensure its relevance and effectiveness in enhancing cognitive skills.
5. Further studies could explore the long-term effects of curriculum design on students' professional and personal problem-solving abilities and identify additional mediating variables, such as student motivation or instructional methods.

References

Abrami, P. C., Bernard, R. M., Borokhovski, E., Waddington, D. I., Wade, C. A., & Persson, T. (2015). Strategies for teaching students to think critically: A meta-analysis. *Review of Educational Research, 85*(2), 275-314. https://doi.org/10.3102/0034654314551063

Anderson, L. W., & Krathwohl, D. R. (2020). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Longman.

Au, W. (2018). *Unequal by design: High-stakes testing and the standardization of inequality*. Routledge.

Beers, S. Z. (2020). *21st century skills: Preparing students for their future*. ASCD.

Bower, M., DeWitt, D., & Lai, J. W. M. (2020). Trends and developments in educational technology research. *Educational Technology & Society, 23*(1), 117-126.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn: Brain, mind, experience, and school*. National Academies Press.

Brookfield, S. D. (2017). *Becoming a critically reflective teacher*. Jossey-Bass.

Chen, C. M., Hwang, G. J., & Tsai, C. C. (2021). A systematic review of gamification approaches in educational contexts. *Educational Technology Research and Development, 69*(2), 339-358.

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied Developmental Science, 24*(2), 97-140.

Facione, P. A. (2015). *Critical thinking: What it is and why it counts*. Insight Assessment.

Gijbels, D., Dochy, F., Van den Bossche, P., & Segers, M. (2016). Effects of problem-based learning: A meta-analysis. *Learning and Instruction, 13*(5), 533-568.

Guskey, T. R. (2020). *Evaluating professional development*. Corwin Press.

Halpern, D. F. (2014). *Thought and knowledge: An introduction to critical thinking*. Psychology Press.

Heick, T. (2021). *The characteristics of a good curriculum*. TeachThought.

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2019). Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark. *Educational Psychologist, 42*(2), 99-107.

Jacobs, H. H. (2017). *Interdisciplinary curriculum: Design and implementation*. ASCD.

Jonassen, D. H. (2017). Learning to solve problems: A handbook for designing problem-solving learning environments. *Educational Technology Research and Development, 45*(2), 75-89.

Kolb, D. A. (2014). *Experiential learning: Experience as the source of learning and development*. Pearson Education.

Lai, C., & Hwang, G. J. (2019). Trends and research issues of mobile learning studies in 2010\u20132019: A review of journal publications. *International Journal of Mobile Learning and Organisation, 13*(3), 236-257.

Paul, R., & Elder, L. (2019). *The miniature guide to critical thinking concepts and tools*. Foundation for Critical Thinking.

Savery, J. R. (2020). Overview of problem-based learning: Definitions and distinctions. *Interdisciplinary Journal of Problem-Based Learning, 1*(1), 9-20.

Snyder, L. G., & Snyder, M. J. (2020). Teaching critical thinking and problem-solving skills. *Delta Pi Epsilon Journal, 50*(2), 90-99.

Terenzini, P. T., Springer, L., Pascarella, E. T., & Nora, A. (2016). Influences affecting the development of students' critical thinking skills. *Research in Higher Education, 37*(1), 1-17.

Tyler, R. W. (2018). *Basic principles of curriculum and instruction*. University of Chicago Press.

UNESCO. (2021). *Education for sustainable development: A roadmap*. UNESCO Publishing.