

Adoption, Use, and Ethical Concerns of Generative Artificial Intelligence Tools among Higher Secondary Computer Science Teachers in Kerala

¹ Geethu. Narayan, ² Dr A. Poongodi

¹Research Scholar, School of Computing Sciences, Vels Institute of Science, Technology & Advanced Studies, Chennai. Email: geethunarayan99@gmail.com, Phone: 9496573263

²Assistant Professor, School of Computing Sciences, Vels Institute of Science, Technology & Advanced Studies, Chennai. Email: apoongodi.scs@vistas.ac.in, Phone: 9710907426

Abstract—Generative Artificial Intelligence (GenAI) tools have created new possibilities as well as ethical challenges in school education. The present study examined the adoption, use, and ethical concerns of Generative AI tools among higher secondary Computer Science teachers in Kerala. A descriptive survey design was adopted. The sample comprised 300 teachers selected through multistage stratified random sampling. Data were collected using a structured questionnaire comprising scales on Generative AI adoption, use, and ethical concerns. The data were analysed using EDUSTAT statistical software through mean, standard deviation, Pearson's product-moment correlation, independent-samples t test, one-way analysis of variance, and Tukey's HSD test. The results showed favourable adoption, moderate use, and high ethical concerns. Adoption was positively related to use, and use was positively related to ethical concerns. Adoption differed significantly by gender, teaching experience, and school management type, whereas ethical concerns did not differ significantly across these variables. The findings emphasise the need for practical teacher training, digital support, and ethical-use guidelines for the responsible integration of GenAI in higher secondary Computer Science education.

Keywords—Generative Artificial Intelligence; Computer Science Teachers; Ethical Concerns

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I. INTRODUCTION

Generative Artificial Intelligence (GenAI) has emerged as an important development in educational technology. Tools such as ChatGPT, Gemini, Microsoft Copilot, Claude, and similar applications can generate text, code, explanations, questions, images, summaries, and other forms of content in response to user prompts. Unlike earlier digital tools that mainly supported information retrieval or content delivery, GenAI enables users to interact with systems that can produce instructional materials, examples, feedback, and solutions. Its rapid availability has created new possibilities for teaching, learning, assessment, and professional development across different levels of education.

In school education, Generative AI can support teachers in preparing lesson plans, generating learning materials, developing worksheets, creating questions, simplifying difficult concepts, and providing alternative explanations. Its relevance is especially notable for Computer Science teachers because these tools can assist in preparing programming examples, explaining algorithms, identifying coding errors, generating exercises, and supporting project-based learning. Such uses can reduce routine preparation

work and enable teachers to devote greater attention to classroom interaction, learner support, and higher-order thinking. However, the educational value of GenAI depends on teachers' ability to evaluate AI-generated content critically and use it in accordance with sound pedagogical principles.

II. BACKGROUND OF THE STUDY

The adoption of Generative AI tools by teachers is shaped by their awareness, perceived usefulness, confidence, access to digital facilities, prior experience, and institutional support. A teacher can recognise the potential value of GenAI without using it regularly in classroom practice. Hence, it is useful to distinguish between adoption and use. Adoption refers to teachers' readiness, willingness, and positive disposition towards integrating GenAI in their professional work, whereas use refers to the frequency with which the tools are employed for activities such as lesson planning, content preparation, programming support, assessment preparation, and professional learning.

The increasing educational use of Generative AI has also raised ethical concerns. AI-generated responses can be inaccurate, incomplete, biased, or unsuitable for a particular learning level. Other

concerns include plagiarism, academic dishonesty, copyright, privacy of student information, reduced originality, excessive dependence on AI-generated responses, and challenges in conducting fair assessment. These concerns make responsible human oversight, verification of outputs, critical thinking, and clear institutional guidance essential. UNESCO has similarly emphasised a human-centred approach to Generative AI in education, with attention to data privacy, ethical validation, pedagogical appropriateness, and policy frameworks.

Higher secondary Computer Science teachers are positioned at the intersection of technological innovation and classroom practice. They are expected not only to teach programming, computational thinking, and digital applications, but also to guide students in the responsible use of emerging technologies. Kerala has a strong tradition of school education and digital learning initiatives, yet access to facilities, exposure to training, teaching experience, and institutional support differ across school contexts. The present study therefore examined the adoption, use, and ethical concerns of Generative AI tools among higher secondary Computer Science teachers in Kerala.

III. RESEARCH FRAMEWORK

A. Research Questions

- 1) Is there a significant relationship between the adoption of Generative AI tools and their use among higher secondary Computer Science teachers in Kerala?
- 2) Is there a significant relationship between the use of Generative AI tools and ethical concerns among higher secondary Computer Science teachers in Kerala?
- 3) Do higher secondary Computer Science teachers in Kerala differ significantly in their adoption of Generative AI tools with respect to gender, teaching experience, and type of school?
- 4) Do higher secondary Computer Science teachers in Kerala differ significantly in their ethical concerns regarding Generative AI tools with respect to gender, teaching experience, and type of school?

B. Research Objectives

- 1) To examine the relationship between the adoption of Generative AI tools and their use among higher secondary Computer Science teachers in Kerala.
- 2) To examine the relationship between the use of Generative AI tools and ethical concerns among higher secondary Computer Science teachers in Kerala.
- 3) To examine whether the adoption of Generative AI tools differs among higher secondary Computer Science teachers in Kerala with respect to gender, teaching experience, and type of school.
- 4) To examine whether ethical concerns regarding

Generative AI tools differ among higher secondary Computer Science teachers in Kerala with respect to gender, teaching experience, and type of school.

C. Hypotheses

- H₀₁: There is no significant relationship between the adoption of Generative AI tools and their use among higher secondary Computer Science teachers in Kerala.
- H₀₂: There is no significant relationship between the use of Generative AI tools and ethical concerns among higher secondary Computer Science teachers in Kerala.
- H₀₃: There is no significant difference in the adoption of Generative AI tools among higher secondary Computer Science teachers in Kerala with respect to gender, teaching experience, and type of school.
- H₀₄: There is no significant difference in ethical concerns regarding Generative AI tools among higher secondary Computer Science teachers in Kerala with respect to gender, teaching experience, and type of school.

IV. METHODOLOGY

The study adopted a descriptive survey design to examine the adoption, use, and ethical concerns of Generative Artificial Intelligence tools among higher secondary Computer Science teachers in Kerala. The study focused on teachers' level of adoption of GenAI tools, their frequency of use for professional and instructional purposes, and their concerns regarding the ethical implications of such tools in education.

A. Population and Sample

The population consisted of all higher secondary Computer Science teachers working in Government, Aided, and Unaided Higher Secondary Schools in Kerala. A sample of 300 higher secondary Computer Science teachers was selected using multistage stratified random sampling. Initially, schools were considered across different regions of Kerala and were classified according to management type. Teachers were then selected from the identified schools. Only teachers who were currently teaching Computer Science at the higher secondary level and were willing to participate were included in the study.

B. Instrumentation

Data were collected using a structured questionnaire prepared for the study. The questionnaire contained a personal and professional profile section and three scales: a 14-item Generative AI Adoption Scale, a 14-item Generative AI Use Scale, and a 16-item Ethical Concerns regarding Generative AI Scale. The adoption and ethical-concerns scales used a five-point response continuum from Strongly Disagree to Strongly Agree. The use scale employed a five-point frequency continuum from Never to Very Often. Higher scores indicated

higher adoption, more frequent use, and greater ethical concern, respectively.

C. Statistical Analysis

The data were coded, classified, tabulated, and analysed using EDUSTAT statistical software. Mean and standard deviation were used to describe the major variables. Pearson's product-moment correlation was applied to examine relationships among adoption, use, and ethical concerns. Independent-samples t test was used for gender-wise comparison, and one-way analysis of variance was used to examine differences based on teaching experience and school management type. Tukey's HSD post-hoc test was employed only when an analysis of variance result was significant. The level of significance was fixed at .05.

V. DATA ANALYSIS AND INTERPRETATION

The data collected from 300 higher secondary Computer Science teachers in Kerala were analysed using EDUSTAT. The required descriptive and inferential statistics are presented below.

TABLE I. Descriptive Statistics of Generative AI Adoption, Use, and Ethical Concerns

Variable	Items	N	Mean	SD	Mean per item
Generative AI Adoption	14	300	50.65	7.26	3.62
Generative AI Use	14	300	45.29	12.01	3.24
Ethical Concerns regarding Generative AI	16	300	63.99	6.89	4.00

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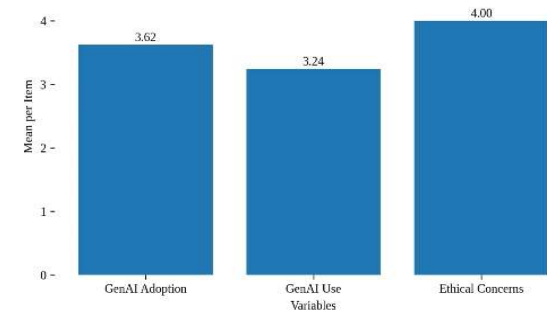


Table I shows that the teachers had a favourable level of adoption of Generative AI tools, with a mean item score of 3.62. Their actual use of the tools was moderate, with a mean item score of 3.24. Ethical concerns were high, as indicated by a mean item score of 4.00. Thus, the teachers generally recognised the usefulness of Generative AI tools while also showing

substantial concern about their responsible and ethical use.

TABLE II. Relationship of Adoption with Use and of Use with Ethical Concerns

Variables	N	Pearson's r	p value	Decision
Generative AI Adoption and Generative AI Use	300	.615	< .001	The null hypothesis was rejected.
Generative AI Use and Ethical Concerns	300	.566	< .001	The null hypothesis was rejected.

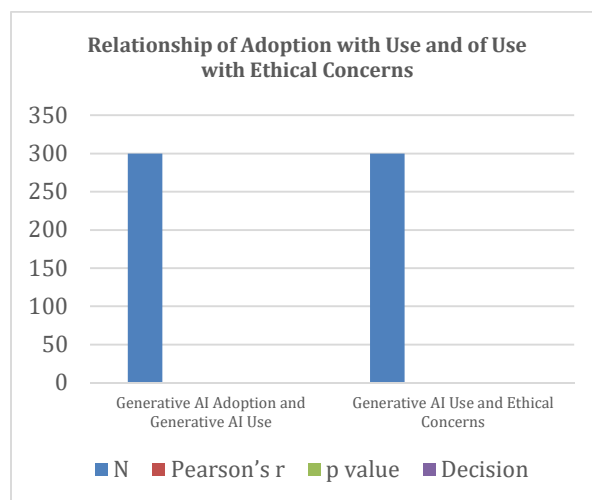


Table II reveals a significant positive relationship between Generative AI adoption and Generative AI use ($r = .615$, $p < .001$). Therefore, the first null hypothesis was rejected. Teachers with higher adoption scores tended to use Generative AI tools more frequently in their professional and instructional activities. Table II also shows a significant positive relationship between Generative AI use and ethical concerns ($r = .566$, $p < .001$). Hence, the second null hypothesis was rejected. Teachers who used Generative AI tools more frequently also reported greater awareness of issues relating to accuracy, plagiarism, privacy, bias, copyright, and fair assessment.

TABLE III. Differences in Generative AI Adoption with respect to Selected Variables

Variable	Group	N	Mean $\pm$ SD	Test result (p value)
Gender	Male	153	51.65 $\pm$ 6.96	t(293) = 2.558 (.011)
	Female	142	49.50 $\pm$ 7.45	
Teaching experience	Below 5 years	64	53.25 $\pm$ 7.32	F(3, 296) = 8.156 (< .001)
	5–10 years	96	51.81 $\pm$ 7.35	
	11–15 years	80	49.33 $\pm$ 6.71	
	Above 15 years	60	47.77 $\pm$ 6.47	
School management type	Government	99	49.15 $\pm$ 7.09	F(2, 297) = 4.550 (.011)
	Aided	145	50.87 $\pm$ 7.48	
	Unaided	56	52.71 $\pm$ 6.45	

Note. Five respondents who selected “prefer not to disclose” under gender were excluded from the gender-wise comparison.

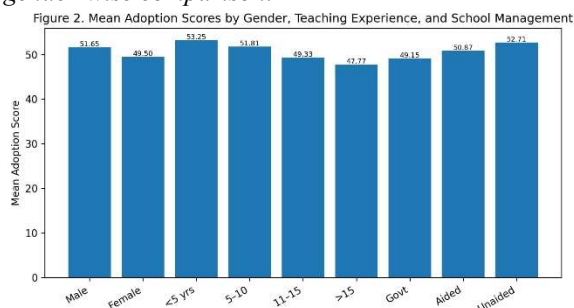
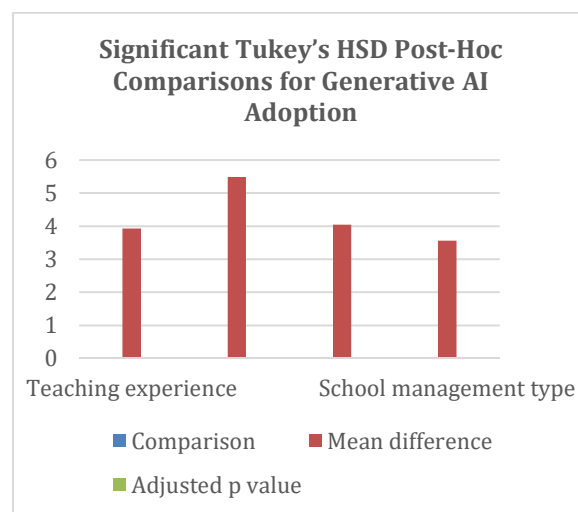


Table III indicates significant differences in Generative AI adoption with respect to gender, teaching experience, and school management type. Male teachers had significantly higher adoption scores than female teachers. Significant differences were also observed across teaching-experience groups and school-management types. Therefore, the third null hypothesis was rejected.

TABLE IV. Significant Tukey’s HSD Post-Hoc Comparisons for Generative AI Adoption

Variable	Comparison	Mean difference	Adjusted p value
Teaching experience	Below 5 years vs 11–15 years	3.925	.005
	Below 5 years vs Above 15 years	5.483	< .001
	5–10 years vs Above 15 years	4.046	.003
School management type	Unaided vs Government	3.563	.009



As the ANOVA results for teaching experience and school management type were significant, Tukey’s HSD post-hoc test was conducted. Table IV shows that teachers with below five years of experience had significantly higher adoption than teachers with 11–15 years and above 15 years of experience. Teachers with 5–10 years of experience also had higher adoption than those with above 15 years of experience. Further, teachers in unaided schools had significantly higher adoption than teachers in Government schools. No other pair-wise comparisons were significant.

TABLE V. Differences in Ethical Concerns regarding Generative AI with respect to Selected Variables

Grouping variable	Test used	Test result	p value	Decision
Gender	Welch independent-samples t test	$t(270.941) = 0.805$	.421	The null hypothesis was not rejected.
Teaching experience	One-way ANOVA	$F(3, 296) = 2.383$	.070	The null hypothesis was not rejected.
School management type	One-way ANOVA	$F(2, 297) = 0.849$	.429	The null hypothesis was not rejected.

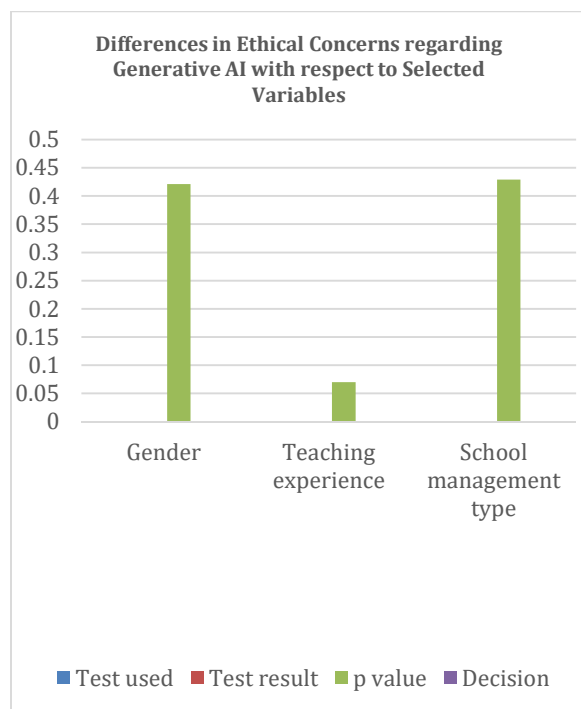


Table V reveals that ethical concerns regarding Generative AI tools did not differ significantly by gender, teaching experience, or school management type. Since all obtained p values were greater than .05, the fourth null hypothesis was not rejected. As the

ANOVA results were not significant, post-hoc comparisons were not conducted.

VI. DISCUSSION OF THE RESULTS

The study found that higher secondary Computer Science teachers in Kerala had a favourable level of adoption of Generative AI tools, while their actual use in professional and instructional activities was moderate. This suggests that teachers generally recognised the educational relevance of GenAI tools, particularly for programming support, lesson planning, instructional-material preparation, and explaining difficult concepts. The lower level of actual use compared with adoption indicates that positive attitudes do not automatically translate into routine classroom practice. The gap reflected factors such as limited training, inadequate infrastructure, lack of institutional guidance, time constraints, and uncertainty about appropriate use.

A significant positive relationship was found between Generative AI adoption and use. Teachers with stronger acceptance, willingness, and confidence towards GenAI used the tools more frequently for lesson planning, material preparation, programming examples, question preparation, and professional learning. The finding indicates that building teachers' awareness and confidence through practical training can facilitate more meaningful integration of Generative AI in higher secondary Computer Science education.

The study also found a significant positive relationship between GenAI use and ethical concerns. Teachers who used the tools more frequently reported greater awareness of concerns relating to inaccurate information, plagiarism, privacy, bias, copyright, student dependency, and assessment fairness. This result suggests that regular use does not necessarily result in uncritical acceptance. Rather, direct engagement with the tools was accompanied by greater awareness of their limitations and risks. Professional development should therefore combine technical competence with ethical literacy.

Generative AI adoption differed significantly by gender, teaching experience, and school management type. Male teachers reported higher adoption than female teachers in the present sample. Teachers with fewer years of experience showed higher adoption than more experienced teachers, and teachers in unaided schools showed higher adoption than teachers in Government schools. These differences reflected variations in exposure to emerging technologies, access to facilities, institutional encouragement, and confidence in experimenting with new applications. The result highlights the need for equitable training and support across teacher groups and school settings.

Ethical concerns did not differ significantly by gender, teaching experience, or school management

type. This implies that issues of academic integrity, privacy, accuracy, bias, copyright, student dependency, and assessment fairness were widely shared among teachers. The common nature of these concerns indicates the need for clear school-level and state-level guidelines for the responsible educational use of Generative AI tools.

VII. IMPLICATIONS AND RECOMMENDATIONS

The results have important implications for higher secondary Computer Science education in Kerala. Since teachers showed favourable adoption but moderate actual use, practical and sustained professional-development programmes are required. Training should demonstrate the responsible use of GenAI for lesson planning, learning-material preparation, programming examples, classroom activities, question construction, and professional learning.

The significant relationship between adoption and use implies that awareness, willingness, and confidence are central to effective integration. Teacher education institutions, school authorities, and education departments should organise workshops and hands-on orientation programmes that enable teachers to understand both the capabilities and limitations of Generative AI tools. More experienced teachers require targeted support, peer mentoring, and practical demonstrations to build confidence in using new technologies.

The observed differences by school management type indicate the need for equitable access to reliable internet connectivity, appropriate digital devices, and institutional encouragement. Government and Aided schools require strengthened digital infrastructure and equal opportunities for GenAI-related professional development. Such support can reduce uneven adoption and promote wider access to technology-enabled teaching practices.

The high level of ethical concern underscores the necessity of institutional guidelines on verification of AI-generated content, protection of student data, responsible prompt use, acknowledgement of AI-assisted work, prevention of plagiarism, and teacher accountability. Ethical literacy should be integrated into teacher training so that GenAI functions as a supportive educational resource rather than a substitute for professional judgement, student creativity, or independent learning.

VIII. CONCLUSION

The study concluded that higher secondary Computer Science teachers in Kerala showed a favourable level of adoption of Generative Artificial Intelligence tools, although their actual use in professional and instructional activities was moderate. Adoption was positively and significantly related to

use, indicating that teachers with greater willingness, awareness, and confidence towards Generative AI used such tools more frequently. Generative AI use was also positively associated with ethical concerns, suggesting that regular users were more aware of issues relating to accuracy, plagiarism, privacy, bias, copyright, student dependency, and assessment fairness. Adoption differed significantly by gender, teaching experience, and school management type, whereas ethical concerns remained broadly similar across these groups. The findings highlight the need for practical teacher training, equitable access to digital facilities, institutional support, and clear ethical guidelines to ensure the responsible and meaningful integration of Generative AI tools in higher secondary Computer Science education in Kerala.

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