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Original Article

생성형 AI 학습 활용과 치위생과 학생의 인지된 학습 성취도 및 학습 윤리 인식 간의 관련성

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Associations between generative artificial intelligence use in learning with perceived academic achievement and academic integrity awareness among dental hygiene students

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Abstract

Objectives: This study examined the associations of generative artificial intelligence (AI) use in learning with perceived academic achievement and academic integrity awareness among dental hygiene students. **Methods:** A cross-sectional survey using a structured questionnaire was conducted with 138 dental hygiene students. Data were analyzed using independent t-tests, one-way analysis of variance, Pearson's correlation analysis, and hierarchical multiple regression analysis. **Results:** Generative AI use in learning was strongly and positively correlated with perceived academic achievement (r=0.863, p<0.01), and this association remained significant after adjusting for year of study, age, and satisfaction with one's major (B=1.016, 95% confidence interval [CI]: 0.912 to 1.120, p<0.001). By contrast, academic integrity awareness was not significantly associated with generative AI use (B=−0.026, 95% CI: −0.154 to 0.101, p>0.05) but was significantly associated with satisfaction with one's major (B=0.179, 95% CI: 0.073 to 0.285, p<0.01). **Conclusions:** Generative AI use in learning was positively associated with perceived academic achievement but not with academic integrity awareness, which was instead associated with satisfaction with one's major. Because all variables were self-reported at a single time point, common method bias cannot be excluded, and the cross-sectional design precludes causal interpretation.

Keywords: Academic achievement, Dental hygiene students, Generative AI, Higher education, Integrity awareness

Introduction

Recent advancements in and the widespread adoption of generative AI (artificial intelligence) technologies have precipitated substantial changes to learning methods and instructional structures across higher education environments [1]. Generative AI systems based on large language models perform a variety of functions, including text generation, information summarization, and problem-solving assistance, and are already being widely used by university students in their coursework and learning processes [2]. A considerable proportion of college students have previously reported utilizing generative AI for academic purposes,

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in the context of assignments, report writing, and exam preparation. These students generally hold a positive perception of these tools, perceiving them as associated with learning efficiency and convenience [3]. Consequently, generative AI has evolved beyond a rudimentary information tool and has been recognized as a learning support resource, prompting active discussions regarding its educational applicability and pedagogical implications in higher education settings [4]. However, alongside its rapid diffusion, there is an increasing need for systematic examination of how generative AI utilization is associated with students' cognitive processes and learning-related outcomes, as well as how these technologies should be appropriately managed and integrated in educational contexts [3,5].

Generative AI has been discussed as an educational tool that may be associated with reduced cognitive burden and perceived learning efficiency through functions such as information retrieval and summarization, idea generation, and problem-solving support [2,3]. The relationship between the utilization of generative AI and perceived academic achievement may be explained through several theoretical mechanisms suggested in previous studies. Firstly, the utilization of generative AI may be associated with self-directed learning by empowering students to access, organize, and apply information autonomously, which may be related to greater learning autonomy. Secondly, it may be associated with higher levels of learning engagement. Previous studies have suggested that perceived efficiency and cognitive support may be related to more active engagement in learning activities. Finally, previous studies have suggested that AI-generated structured explanations and examples may be associated with comprehension and more positive perceptions of academic achievement. It has been posited by preceding research that the utilization of generative AI may be related to learning engagement and self-directed learning, which may be associated with perceived academic achievement, particularly in the initial stages of learning when guidance is required in order to develop conceptual understanding and establish the correct direction for learning [4,5]. Nevertheless, alongside these potential educational advantages, the limitations of generative AI have also been consistently highlighted. It is important to note that information generated by AI systems does not guarantee accuracy or reliability. Indeed, AI-generated information may contain contextual errors or misinformation, which may be associated with reduced opportunities for critical reflection [2,3]. Furthermore, when students employ AI-generated outputs without comprehending the content in its entirety, such practices may be related to greater reliance on AI-generated outputs or superficial engagement in the learning process, issues pertaining to perceived academic achievement [3]. Moreover, issues pertaining to integrity awareness, including proper source attribution, assignment outsourcing, and the maintenance of scholarly honesty, have emerged as critical concerns in higher education contexts. This underscores the necessity for clear standards and educational interventions regarding the utilization of generative AI [1,6]. However, self-directed learning, learning engagement, and cognitive support were not directly measured in the present study and are discussed only as potential explanatory mechanisms suggested in previous literature.

The educational utilization of generative AI does not invariably bear equivalent implications across all academic disciplines; rather, it engenders discipline-specific concerns contingent on academic and professional attributes necessitating meticulous scrutiny, particularly within the context of health-related education [7]. In health professions education, a strong emphasis is placed on professional ethics, clinical judgment, accuracy, and accountability. Consequently, the accuracy and utilization of information provided by generative AI may be associated with learning-related perceptions and aspects of professional identity formation [8]. A number of studies in the fields of nursing and life-science education have previously reported that while generative AI has been discussed as a resource that may support conceptual understanding and learning activities, concerns regarding the accuracy of the information provided and the potential for overdependence among learners mean that its full potential in these fields has yet to be realized [9]. In this context, studies targeting dental hygiene students have also reported that experiences with and perceptions of generative AI vary widely. In the domain of dental hygiene education, where clinical skills and the capacity for making judgments in real-world scenarios are paramount, the integration of generative AI should be carefully designed to support learning activities while ensuring that it does not compromise students' critical thinking and ethical judgment [6,9]. In particular, education in dental

hygiene places significant emphasis on professional ethics, clinical decision-making skills, and the assumption of responsibility for patient care. Consequently, an excessive reliance on AI-generated information may be associated with learning-related perceptions as well as ethical judgment and professional conduct within clinical contexts. This underscores the necessity of evaluating both perceived academic achievement and integrity awareness when assessing the utilization of generative AI in this domain. Furthermore, attitudes towards the adoption of generative AI technologies in healthcare fields may vary according to individuals' professional perceptions and sense of responsibility, suggesting that the associations between AI use, perceived academic achievement, and integrity awareness may differ by disciplinary context [10,11]. Consequently, the integration of generative AI within the domain of dental hygiene education constitutes a multifaceted issue necessitating meticulous examination of its educational merits in conjunction with professional ethics, learning accountability, and clinical reasoning skills. This underscores the imperative for a systematic investigation within this discipline [7].

A number of studies have previously investigated the educational potential and limitations of generative AI across a range of disciplines and instructional contexts. The majority of these studies have focused on students' usage experiences, perceptions, attitudes, and ethical or psychological responses [1,11]. Despite the reported associations between generative AI utilization and perceived learning efficiency and productivity within higher education settings, concerns regarding the reliability of information, integrity awareness, and the potential for excessive reliance persist [6,12]. Research in health and medical education has indicated that generative AI may be associated with conceptual learning and theoretical understanding, while simultaneously necessitating cautious use due to potential declines in responsibility within professional education contexts [7,8]. Research in nursing and life-science education has suggested that greater use of generative AI may be associated with lower levels of critical thinking and increased ethical ambiguity among some learners [9]. However, the majority of extant studies have focused on usage patterns or perceptual outcomes, providing limited empirical evidence regarding the association between generative AI-based learning utilization, perceived academic achievement, and integrity awareness [11,13].

Previous research in health-related education has primarily focused on students' perceptions, attitudes, and ethical concerns regarding the use of generative AI, with particular attention to fields such as nursing and medical education [7–9]. These studies have highlighted the dual nature of generative AI, emphasizing both its potential to support learning and its risks in relation to professional responsibility and ethical judgment. However, relatively limited attention has been given to dental hygiene students, despite the unique characteristics of this discipline. Dental hygiene education places strong emphasis on clinical decision-making, accuracy, and professional accountability, as students are directly involved in patient-centered care and preventive oral health services. These discipline-specific demands suggest that the implications of generative AI utilization may differ meaningfully from those observed in other health-related fields. Therefore, further investigation is required to better understand how generative AI utilization is associated with perceived academic achievement and integrity awareness within this specific population. By focusing on dental hygiene students, the present study aims to address this gap and provide more context-specific evidence for the appropriate and ethical integration of generative AI in health professions education.

In particular, studies examining generative AI learning utilization, perceived academic achievement, and integrity awareness among dental hygiene students—who require strong professional ethics and clinical judgment—remain scarce, warranting comprehensive investigation [7].

In light of the aforementioned context, the present study aims to examine the associations between utilization of generative AI-based learning and perceived academic achievement, as well as integrity awareness, among dental hygiene students. The present study aims to identify whether there is a discrepancy in perceived academic achievement according to levels of generative AI learning utilization, and to examine the relationships between AI utilization and perceptions of integrity awareness [6,11]. The objective of this research is to explore the educational potential and limitations of generative AI as a learning support tool in dental hygiene education and to propose an ethically informed and pedagogically balanced framework appropriate for professional

education contexts [7,14]. Moreover, the findings of this study are intended to provide foundational evidence for the educational management and instructional design of generative AI as a learning resource that incorporates considerations of both perceived academic achievement and integrity awareness.

Methods

1. Subjects

The study participants comprised 310 students from the Department of Dental Hygiene at Sahmyook University. The study was approved following review by the Institutional Review Board (IRB No. 2-70094958-A-N-01-250515-HR-010-01). Of these, 138 (44.5%) agreed to participate voluntarily after receiving a full explanation of the study's objectives. The survey was conducted online via a self-administered questionnaire on Google Forms (Google LLC, Mountain View, CA, USA) from 1 to 12 June 2025, and participants were permitted to withdraw from the study at any time. The minimum required sample size was calculated using G*Power (version 3.1.9.7; Heinrich Heine University Düsseldorf, Germany) based on a multiple regression analysis with a significance level (α) of 0.05, a power(1−β) of 0.95 and an effect size of 0.285, resulting in a required sample size of 58. The effect size was determined by referring to the coefficient of determination (R^2) from a previous study [4]. The final sample of 138 participants satisfied the minimum requirement, assuming 60% rate of attrition.

To ensure voluntary participation and minimize potential coercion due to the hierarchical relationship between faculty members and students, several measures were implemented. Participation was entirely voluntary, and students were informed that their decision to participate or decline would not affect their academic evaluation or standing. The survey was conducted anonymously, and no identifiable information was collected. Although the questionnaire was developed by a faculty member, participant recruitment and survey administration were conducted by a research assistant who was not involved in student evaluation, and the study was designed to prevent direct interaction between students and the faculty member responsible for their academic assessment.

2. Variables

The questionnaire employed in this study was revised and supplemented based on previous research [1,3,5−8,11,13−14], comprising a total of 18 items across four domains: general characteristics (5 items), utilization of generative AI for learning (5 items), perceived academic achievement (4 items), and integrity awareness (5 items). The general characteristics encompassed gender, year of study, age, satisfaction with one's major, and prior experience. The utilization of generative AI for learning comprised items assessing the use of generative AI tools for assignments, perceived usefulness for learning, perceived learning efficiency, perceived applicability to learning activities, and intention to use. Perceived academic achievement comprised items assessing understanding of course content, learning processes, learning confidence, and perceived learning ability. In this study, perceived academic achievement was operationalized as students' perceived learning outcomes and self-evaluated academic performance, which may partially reflect self-efficacy and learning confidence rather than objective academic performance. Integrity awareness was operationally defined as students' perceptions and attitudes regarding responsible academic behavior, including source citation, awareness of academic misconduct, personal responsibility, and the need for ethical guidelines, rather than actual observed ethical behaviors.

The evaluation of each item was conducted using a 5-point Likert scale.

All measurement items were adapted and refined from those reported as valid in prior research, and Cronbach's α coefficients were calculated to verify internal consistency. The α value for the utilization of generative AI in learning was 0.883, for perceived academic achievement 0.962, and for integrity awareness 0.729.

3. Data analysis

The collected data were analyzed using SPSS statistical software (ver. 18.0; IBM Corp., Armonk, NY, USA), with a significance level (α) set at 0.05. As all variables were measured using self-reported Likert-type scales at a single time point, the possibility of common method bias cannot be ruled out. Frequency analysis and descriptive statistics were performed in order to examine the general characteristics of the study participants and the distribution of key variables. In order to examine differences in utilization of generative AI for learning, perceived academic achievement and integrity awareness according to the general characteristics of the study participants, independent samples t-test or one-way analysis of variance (ANOVA) was conducted, followed by post-hoc tests using Scheffé's method. Pearson's correlation analysis was performed to investigate the relationship among utilization of generative AI learning and perceived academic achievement and integrity awareness. Furthermore, multiple regression analysis was performed, controlling for general characteristics, to examine whether the utilization of generative AI in learning was independently associated with perceived academic achievement and integrity awareness. Prior to conducting the regression analysis, the tolerance limits and the variance inflation factor (VIF) were examined to evaluate the presence of multicollinearity. The relationship between the utilization of generative AI in learning and the key outcome variables was interpreted based on the findings derived from the analysis.

Results

Of the 138 study participants, 97.8% were female (135), with 34.0% (47) in their first year, 34.8% (48) in their second year and 31.2% (43) in their third year; the average age was 21.8 years. With regard to satisfaction with their major (on a 3-point scale), 7.3% (10 participants) reported low satisfaction, 39.1% (54 participants) reported moderate satisfaction, and 53.6% (74 participants) reported high satisfaction; the average score was 2.46.

1. Utilization of generative AI according to the characteristics

<Table 1> presents differences in the utilization of generative AI for learning according to participants' characteristics. The results of one-way ANOVA indicated that there were no statistically significant differences in generative AI utilization across years of study in terms of using tool, effectiveness, scalability, and initiative (p>0.05). No statistically significant difference in efficiency was observed according to year of study (F=2.985, p>0.05).

Furthermore, no significant differences were identified across age groups in relation to any of the subdomains of generative AI utilization.

With regard to satisfaction, independent samples t-tests revealed no statistically significant differences between low and high satisfaction groups across most subdomains of generative AI utilization. No statistically significant difference in initiative was observed according to satisfaction with major (t=−1.960, p>0.05).

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Table 1. Utilization of generative AI according to the characteristics (Unit: Mean±SD)

Category	Group	Using tool	Effectiveness	Efficiency	Scalability	Initiative
Year of study	1(n=47)	4.74±0.61	4.26±1.03	4.51±0.75	3.96±1.04	4.47±0.98
	2(n=48)	4.44±0.87	3.94±1.21	4.15±0.85	3.90±1.15	4.06±0.91
	3(n=43)	4.56±0.80	4.19±1.03	4.51±0.91	3.93±0.96	4.07±1.24
	F($p^{\dagger}$)	1.931(0.149)	1.101(0.336)	2.985(0.054)	0.040(0.960)	2.297(0.104)
Age(yr)	17-19(n=48)	4.42±0.92	4.13±1.20	4.40±0.82	3.90±1.13	4.19±1.12
	20-21(n=47)	4.70±0.62	4.04±1.18	4.30±1.00	3.89±1.20	4.26±1.15
	22 and over(n=43)	4.63±0.73	4.21±0.89	4.47±0.70	4.00±0.76	4.16±0.87
	F($p^{\dagger}$)	1.765(0.175)	0.257(0.774)	0.440(0.645)	0.147(0.864)	0.093(0.911)
Satisfaction of major	Low(n=64)	4.50±0.85	4.05±1.20	4.34±0.78	3.83±1.09	4.02±1.03
	High(n=74)	4.65±0.69	4.19±1.00	4.42±0.91	4.01±1.01	4.36±1.05
	t($p^{\ddagger}$)	−1.129(0.261)	−0.759(0.449)	−0.518(0.606)	−1.034(0.303)	−1.960(0.052)

SD: standard deviation.
†by one-way ANOVA and ‡by independent sample t-test at α=0.05.

2. Perceived academic achievement according to the characteristics

<Table 2> presents perceived academic achievement according to participants' characteristics. The application of a one-way analysis of variance (ANOVA) revealed no statistically significant differences across years of study in terms of understanding of subject, learning process, learning confidence, or learning ability (p>0.05).

Furthermore, no significant differences were identified across age groups for any subdomains of perceived academic achievement. No statistically significant difference in learning confidence was observed according to age (F=2.354, p>0.05).

A significant difference in learning process was observed according to satisfaction with major (t=−2.895, p<0.01).

Table 2. Perceived academic achievement according to the characteristics (Unit: Mean±SD)

Category	Group	Understanding of subject	Learning process	Learning confidence	Learning ability
Year of study	1(n=47)	4.17±0.94	4.34±0.84	3.81±1.19	4.38±0.87
	2(n=48)	3.90±1.22	4.02±0.98	3.75±1.02	4.10±1.02
	3(n=43)	3.81±1.12	4.07±0.94	3.91±1.21	4.21±1.19
	F($p^{\dagger}$)	1.284(0.280)	1.640(0.198)	0.217(0.805)	0.888(0.414)
Age(yr)	17-19(n=48)	4.02±1.08	4.17±1.06	3.75±1.23	4.10±1.12
	20-21(n=47)	3.87±1.35	4.11±0.76	3.62±1.26	4.23±1.18
	22 and over(n=43)	4.00±0.87	4.16±0.95	4.12±0.79	4.37±0.69
	F($p^{\dagger}$)	0.240(0.787)	0.061(0.941)	2.354(0.099)	0.769(0.466)
Satisfaction of major	Low(n=64)	3.83±1.12	3.91±1.05	3.77±1.14	4.13±1.00
	High(n=74)	4.08±1.11	4.35±0.75	3.86±1.14	4.32±1.05
	t($p^{\ddagger}$)	−1.331(0.185)	−2.895(0.004)**	−0.511(0.610)	−1.138(0.257)

SD: standard deviation.
†by one-way ANOVA and ‡by independent sample t-test at α=0.05, $^{**}p$<0.01.

3. Integrity awareness according to the characteristics

The results of the analysis examining differences in integrity awareness according to participants' characteristics are presented in <Table 3>. With respect to the year of study, no statistically significant differences were observed across the majority of subdomains of integrity awareness. Although a significant difference was observed for ethical guidelines according to year of study (F=3.121, p<0.05), post-hoc Scheffé tests revealed no statistically significant pairwise group differences.

Significant differences according to age were observed for learning responsibility (F=3.358, p<0.05) and ethical guidelines (F=4.156,

p<0.05). Post-hoc Scheffé tests showed that the 20–21 age group had significantly higher learning responsibility scores than the 17–19 age group (p<0.05).

With regard to satisfaction, independent samples t-tests revealed significant differences in misconduct awareness (t=−2.406, p<0.05), integrity standards (t=−1.990, p<0.05), and ethical guidelines (t=−2.266, p<0.05).

Table 3. Integrity awareness according to the characteristics (Unit: Mean±SD)

Category	Group	Learning responsibility	Source citation	Misconduct awareness	Integrity standards	Ethical guidelines
Year of study	1(n=47)	4.51±0.78	4.49±0.78	3.51±1.06	4.00±0.81	3.85±0.91
	2(n=48)	4.56±0.65	4.60±0.64	4.06±1.02	4.38±0.64	4.29±0.68
	3(n=43)	4.72±0.55	4.40±0.98	3.84±1.36	4.14±0.89	3.91±1.17
	F($p^{\dagger}$)	1.196(0.306)	0.769(0.465)	2.762(0.067)	2.796(0.065)	3.121(0.047)*
Age(yr)	17–19(n=48)	4.42±0.85[a]	4.50±0.72	3.67±1.18	4.19±0.79	3.96±0.87[ab]
	20–21(n=47)	4.77±0.48[b]	4.62±0.68	4.00±1.23	4.28±0.74	4.32±0.89[a]
	22 and over(n=43)	4.60±0.58[ab]	4.37±1.00	3.74±1.07	4.05±0.84	3.77±1.02[b]
	F($p^{\dagger}$)	3.358(0.038)*	1.043(0.355)	1.057(0.350)	0.959(0.386)	4.156(0.018)*
Satisfaction of major	Low(n=64)	4.48±0.78	4.39±0.90	3.55±1.32	4.03±0.84	3.83±1.02
	High(n=74)	4.69±0.55	4.59±0.70	4.03±0.97	4.30±0.74	4.19±0.86
	t($p^{\ddagger}$)	−1.765(0.080)	−1.467(0.145)	−2.406(0.018)*	−1.990(0.049)*	−2.266(0.025)*

SD: standard deviation.
†by one-way ANOVA and ‡by independent sample t-test at α=0.05, *p<0.05, [a,b] Values with the same superscript letter are not significantly different by Scheffé's post-hoc test.

4. Associations among study variables

Pearson's correlation analysis was conducted to examine the associations among learning utilization, perceived academic achievement and integrity awareness. As demonstrated in <Table 4>, learning utilization was significantly correlated with perceived academic achievement (r=0.863, p<0.01). In contrast, no significant correlation was found between learning utilization and integrity awareness (r=−0.022, p>0.05), nor between perceived academic achievement and integrity awareness (r=0.011, p>0.05).

Table 4. Associations among study variables

	Learning utilization	Perceived academic achievement	Integrity awareness
Learning utilization	1		
Perceived academic achievement	0.863***	1	
Integrity awareness	−0.022	0.011	1

***p<0.001, by Pearson's correlation coefficient at α=0.05

5. Hierarchical regression analysis associated with perceived academic achievement

Hierarchical multiple regression analysis was conducted to examine whether the utilization of generative AI for learning was associated with perceived academic achievement, while controlling for year of study, age, and satisfaction with major.

As demonstrated in <Table 5>, Model 1, comprising solely control variables, explained 3.1% of the variance in perceived academic achievement (R^2=0.031) and was not statistically significant (F=1.418, p>0.05).

In Model 2, generative AI learning utilization was incorporated into the regression model. The explained variance increased from R^2=0.031 to R^2=0.747 (ΔR^2=0.716). The overall model was statistically significant (F=97.951, p<0.001), and learning utilization was significantly associated with perceived academic achievement (B=1.016, 95% CI=0.912–1.120, β=0.856, p<0.001).

In contrast, the control variables (year of study, age, and satisfaction with major) were not significant predictors in the final model.

Table 5. Hierarchical multiple regression analysis associated with perceived academic achievement

Variables	Model 1			Model 2		95% CI			Tolerance	VIF
	B	SE	β	B	SE	LL	UL	β		
(Constant)	3.898	0.275	-	−0.326	0.260			-		
Year of study	−0.156	0.117	−0.132	−0.039	0.060	−0.158	0.080	−0.033	0.725	1.378
Age (yr)	0.119	0.120	0.101	0.040	0.062	−0.082	0.163	0.034	0.680	1.470
Satisfaction of major	0.104	0.085	0.109	0.026	0.044	−0.060	0.112	0.027	0.911	1.098
Learning utilization	-	-	-	1.016	0.052	0.912	1.120	0.856**	0.977	1.023
F	1.418			97.951***						
R^2	0.031			0.747						
ΔR^2	-			0.716						

B: unstandardized coefficient; SE: standard error; β: standardized coefficient; CI: confidence interval; LL: lower limit; UL: upper limit; VIF: variance inflation factor; ΔR^2: change in R^2.
**p<0.01, ***p<0.001, by hierarchical multiple regression analysis at α=0.05

6. Hierarchical multiple regression analysis associated with integrity awareness

Hierarchical multiple regression analysis was conducted to examine the factors associated with integrity awareness, while controlling for year of study, age, and satisfaction with major. As demonstrated in <Table 6>, Model 1 accounted for 8.9% of the variance in integrity awareness (R^2=0.089) and was statistically significant (F=4.355, p<0.01). In Model 1, satisfaction with major was significantly associated with integrity awareness (B=0.177, p<0.01).

In Model 2, learning utilization was added to the regression model. The explained variance was R^2=0.090 (ΔR^2=0.001), and the increase in explained variance was not statistically significant. Furthermore, the utilization of generative AI learning was not significantly associated with integrity awareness (B=−0.026, p>0.05). Satisfaction with major remained significantly associated with integrity awareness in the final model (B=0.179, 95% CI=0.073-0.285, β=0.290, p<0.01).

Table 6. Hierarchical multiple regression analysis associated with integrity awareness

Variables	Model 1			Model 2		95% CI			Tolerance	VIF
	B	SE	β	B	SE	LL	UL	β		
(Constant)	3.867	0.173	-	3.977	0.319			-		
Year of study	0.129	0.073	0.169	0.126	0.074	−0.021	0.272	0.165	0.725	1.378
Age (yr)	−0.137	0.076	−0.180	−0.135	0.076	−0.285	0.016	−0.177	0.680	1.470
Satisfaction of major	0.177	0.053	0.287**	0.179	0.053	0.073	0.285	0.290**	0.911	1.098
Learning utilization	-	-	-	−0.026	0.064	−0.154	0.101	−0.034	0.977	1.023
F	4.355**			3.288*						
R^2	0.089			0.090						
ΔR^2	-			0.001						

B: unstandardized coefficient; SE: standard error; β: standardized coefficient; CI: confidence interval; LL: lower limit; UL: upper limit; VIF: variance inflation factor; ΔR^2: change in R^2.
*p<0.05, **p<0.01 by hierarchical multiple regression analysis at α=0.05

Discussion

This study sought to examine the associations between the utilization of generative AI in learning and perceived academic achievement, as well as integrity awareness, among dental hygiene students. The findings of the study demonstrated a robust and positive correlation between the utilization of generative AI in learning and perceived academic achievement. However, given the

high correlation that was observed, this relationship should be interpreted with caution, as it may partially reflect shared measurement methods or response tendencies inherent in self-reported data. Furthermore, it is also possible that students with higher perceived academic achievement or stronger learning motivation were more likely to actively utilize generative AI, suggesting a potential reverse causality in the observed relationship. Therefore, the association identified in this study should not be interpreted as evidence of a causal relationship between generative AI utilization and perceived academic achievement. This association was further supported by the regression analysis, in which generative AI utilization was significantly associated with perceived academic achievement. Additionally, the use of a single self-reported survey may have contributed to common method variance, potentially inflating the observed relationships among variables. This shared measurement context may have amplified both the correlation ($r=0.863$) and the high explanatory power observed in the regression model, and thus should be carefully considered when interpreting the strength of the associations.

No statistically significant association was observed between the utilization of generative AI and integrity awareness. Integrity awareness was predominantly associated with affective factors, particularly satisfaction with one's chosen major.

These findings suggest that generative AI may function as a potential learning support tool and may be associated with learning efficiency. However, it should be noted that the outcome variable reflects perceived academic achievement rather than objective academic performance; therefore, the findings should not be directly interpreted as improvements in actual academic outcomes. Furthermore, given the cross-sectional nature of the study, these findings should be interpreted as indicative of associations rather than causal effects, and thus the educational effectiveness of generative AI should be considered with caution.

Generative AI has been reported to support various academic tasks, including information retrieval, summarization, and idea generation. These functions have been associated with conceptual understanding and the establishment of appropriate learning directions, particularly in the early stages of learning, and have also been associated with perceived academic achievement [2,5]. In addition, generative AI has been reported to promote self-directed learning and increase learning engagement, both of which have been reported to be associated with perceived academic achievement [4,6]. Recent meta-analytic evidence has reported positive associations between generative AI use and cognitive, behavioral, and affective learning outcomes [15]. Moreover, AI-supported learning environments may be associated with students' self-regulation and autonomy, which may also be associated with perceived academic achievement, suggesting that the role of generative AI extends beyond simple task assistance to broader learning processes [16]. Taken together, these findings support the positive association identified in this study between generative AI utilization and perceived academic achievement. However, this relationship should be interpreted with caution, and the potential role of generative AI as a learning support tool should be understood within the limitations of the present study and its cross-sectional design.

Conversely, the finding that generative AI learning utilization was not significantly associated with integrity awareness warrants careful consideration. This lack of a statistically significant association should not be interpreted as evidence of no effect; rather, it may reflect limitations in measurement sensitivity or the influence of unmeasured confounding variables such as ethical awareness, motivation, or contextual factors. These findings suggest that the relationship between the utilization of generative AI and integrity awareness is not straightforward, and integrity awareness may be more strongly shaped by affective factors such as individual values, attitudes, and sense of responsibility. As indicated by previous studies, generative AI has been demonstrated to possess both positive educational functions, such as associations with learning efficiency and engagement, and potential risks related to academic dishonesty [6,12,17]. However, despite these concerns, the relationship between AI utilization and integrity awareness does not appear to be straightforward or consistent. Notably, the relationship between generative AI utilization and integrity awareness is likely to operate in a complex manner depending on learners' ethical beliefs and educational experiences. It has been observed that students tend to perceive the complete utilization of AI-generated work as constituting clear academic misconduct, whereas partial or supportive use is often regarded as less problematic. This discrepancy has been demonstrated to be predominantly influenced by individuals' ethical standards [18]. Therefore, the absence of a statistically significant association should be interpreted with caution and should not be regarded as definitive evidence of no relationship between generative AI utilization and integrity

awareness. In addition, it should be noted that the present study measured the utilization of generative AI as a general construct without differentiating specific types of use, such as information retrieval, assignment writing, summarization, or idea generation. As the educational impact of generative AI may vary depending on the purpose and context of use, this limitation may have influenced the observed relationships and should be addressed in future research.

Furthermore, previous research has indicated that the relationship between AI utilization and integrity awareness is either weak or non-statistically significant, suggesting that AI use itself may not show a consistent association with unethical behavior. Rather, it is a context-dependent factor shaped by situational and cognitive interpretations. Additionally, previous studies have highlighted that integrity awareness-related behaviors are more closely associated with learners' motivation, academic pressure, and achievement goals than with technological factors. Recent studies have indicated that the prevalence of academic misconduct has remained relatively constant despite the integration of AI tools into educational settings. This suggests that integrity awareness is influenced by a complex interplay of psychological and educational factors, rather than being solely determined by technological access [19]. Taken together, these findings suggest that no statistically significant association was observed between generative AI utilization and integrity awareness in the present study. Rather, generative AI may operate within pre-existing frameworks of ethical judgment. Therefore, understanding the impact of generative AI on integrity awareness requires a comprehensive approach that goes beyond mere consideration of technology use, encompassing learners' ethical awareness, sense of responsibility, and educational context. This further underscores the necessity of educational strategies that focus not solely on the regulatory control of AI use, but also on the cultivation of ethical judgment and responsible use of AI in students.

Furthermore, the finding that satisfaction with one's major was significantly associated with integrity awareness warrants careful consideration. This finding suggests that integrity awareness is not solely associated with cognitive learning factors or technological utilization but is more closely associated with affective factors, such as learners' satisfaction with their major, their attitudes, and their sense of identity in relation to their field of study. As indicated by previous studies, higher levels of satisfaction are associated with key psychological factors such as learning engagement, self-efficacy, and academic persistence [5,20].

In the context of health and medical education, professional identity has been reported as an important factor associated with ethical judgment and behavior [7,8]. Professional identity has been described as being formed through the internalization of values, norms, and responsibilities of a given discipline and has been reported to be associated with learners' ethical decision-making [21]. Higher levels of major satisfaction may be associated with stronger professional identity formation, which may be associated with a stronger sense of responsibility and ethical standards.

Moreover, integrity awareness is closely associated with learners' motivation, particularly intrinsic motivation and self-regulated learning attitudes, which have been shown to reduce academic misconduct [22]. Higher major satisfaction may be associated with stronger internalization of learning values, which may be associated with more ethical learning behaviors compared to those driven primarily by external pressure. Taken together, these findings suggest that integrity awareness is shaped through a complex interplay of affective, motivational, and educational factors, rather than being directly influenced by technological use alone [23].

Consequently, the findings of this study suggest that efforts to strengthen integrity awareness should move beyond regulatory or control-based approaches and instead focus on fostering positive perceptions of one's major, associated with learning engagement, and strengthening professional identity.

The findings of this study are largely consistent with previous research, showing that generative AI utilization was positively associated with perceived academic achievement. It has been reported in the literature that generative AI supports learning processes by facilitating information retrieval, summarization, and problem-solving [2,4,5]. This has been associated with learning efficiency and comprehension. In particular, previous studies have consistently reported positive associations between the utilization of generative AI and perceived academic achievement [5,6]. Moreover, recent meta-analytic evidence indicates that generative AI use has been positively associated with perceived academic achievement across cognitive, behavioral and affective domains [15,16],

thereby supporting the strong positive association observed in this study between generative AI utilization and perceived academic achievement.

Conversely, the finding that generative AI utilization was not significantly associated with integrity awareness may be interpreted as both divergent from earlier concerns and partially aligned with more recent research trends. Earlier studies have emphasized the potential risks of generative AI, including plagiarism and assignment outsourcing, highlighting its possible negative implications for integrity awareness [6,8,12]. However, more recent findings suggest that the relationship between AI use and integrity awareness is not straightforward and may vary depending on learners' perceptions and situational contexts [17–19]. These findings imply that no statistically significant association was observed between AI utilization and integrity awareness in the present study; rather, the association may vary according to how learners perceive and use the technology.

Moreover, the finding that satisfaction with one's major was significantly associated with integrity awareness is consistent with previous research emphasizing the importance of affective factors in learning. As demonstrated in previous studies, significant satisfaction is closely associated with psychological variables such as learning engagement, self-efficacy, and academic persistence [5,20]. These variables have been reported to be associated with learners' sense of responsibility and ethical behavior. In the context of health-related disciplines, professional identity has been identified as a pivotal factor associated with ethical awareness and conduct [7,8,21]. Ethical decision-making is closely associated with the development of personal values and attitudes [23]. Furthermore, intrinsic motivation and self-regulated learning have been identified as significant predictors of integrity awareness and as factors that contribute to the reduction of academic misconduct [22].

Taken together, these findings suggest that while generative AI utilization was significantly associated with perceived academic achievement, no statistically significant association with integrity awareness was observed. Instead, affective factors such as learners' attitudes, motivation, and satisfaction with their major appear to play a more critical role in shaping integrity awareness. The findings underscore the significance of leveraging generative AI not only as a potential tool to augment learning but also of instilling ethical awareness and a sense of responsibility among students through educational interventions.

The findings of this study indicate that while generative AI utilization was associated with perceived academic achievement, no statistically significant association was observed with integrity awareness. Instead, affective factors appeared to be more strongly associated with integrity awareness. This observation suggests the importance of considering generative AI from a more learner-centric and integrated perspective. In summary, although generative AI may function as a potential learning support tool associated with perceived academic achievement, value-based domains such as integrity awareness are more likely to be shaped by learners' attitudes, beliefs, and educational experiences. This indicates that their associations may differ and should be interpreted separately.

From a theoretical standpoint, these findings offer significant evidence to support the differentiation between cognitive factors that explain perceived academic achievement and affective factors that underpin integrity awareness. In particular, within technology-enhanced learning environments such as those involving generative AI, learning outcomes may be associated with technological use. In contrast, ethical judgment and behavior are shaped by more complex psychological and social factors. This finding lends further support to the notion that learner-related variables, such as attitudes and motivation, which have been identified as significant factors in models of technology acceptance and self-directed learning, also play a substantial role in the domain of integrity awareness.

From an educational standpoint, the present findings emphasize that the use of generative AI should not be restricted solely through regulation or prohibition, but rather should be supported as a potential learning support tool while simultaneously incorporating strategies to strengthen integrity awareness. In health and dental hygiene education, where professional ethics and accountability are critical, it is particularly important to combine training in the use of generative AI with education aimed at fostering ethical judgment and responsible use. Practical approaches may include providing clear guidelines for AI use, implementing ethics-based case instruction, and adopting process-oriented assessment methods.

In conclusion, generative AI utilization was significantly associated with perceived academic achievement; however, no statistically significant association was observed with integrity awareness. The implications of generative AI for integrity awareness require a comprehensive approach that takes into account learners' attitudes and educational context. These findings offer important implications for developing future strategies for the integration of generative AI in higher education. Therefore, caution is warranted when interpreting the observed association between generative AI utilization and perceived academic achievement, and the findings should be understood as reflecting associations rather than causal relationships.

It is imperative to acknowledge the limitations of this study. Firstly, given that all variables were measured using self-reported Likert-type scales collected at a single time point, the possibility of common method bias cannot be excluded. Secondly, potential confounding variables such as prior academic performance, self-directed learning ability, and digital literacy were not included in the analysis. It is possible that these factors may have influenced both the utilization of generative AI and perceived academic achievement, thereby limiting the ability to isolate the independent effect of AI utilization. Thirdly, the absence of objective academic indicators (e.g., grade point average) further limits the interpretation of the independent contribution of generative AI utilization to perceived academic achievement. Therefore, caution is required when interpreting the findings. Fourthly, given that the study was conducted at a single university and relied on voluntary participation, there is a possibility of selection bias, which may limit the generalizability of the findings. The fifth limitation of this study is that, due to the cross-sectional research design, it is unable to establish causal relationships between variables. Sixthly, although perceived academic achievement was measured using validated items, it reflects students' perceived learning outcomes and self-evaluated academic performance, which may partially overlap with constructs such as self-efficacy or learning confidence rather than objective perceived academic achievement.

It is recommended that future research adopts a more comprehensive approach in order to facilitate a more profound comprehension of the relationship between the utilization of generative AI and integrity awareness. This would be achieved by incorporating variables such as learners' ethical awareness, motivation, and educational environment. Furthermore, additional studies are required to develop and evaluate educational programs that facilitate the effective utilization of generative AI while upholding integrity awareness. These efforts will provide a critical foundation for the sustainable integration of generative AI in higher education.

Conclusions

This study examined the associations between the utilization of generative AI-based learning, perceived academic achievement, and integrity awareness among dental hygiene students.

1. A significant positive association was observed between the utilization of generative AI and perceived academic achievement. However, no statistically significant association was observed between generative AI utilization and integrity awareness.

2. Integrity awareness was significantly associated with satisfaction with one's major, whereas no statistically significant association was observed with generative AI utilization.

Given the cross-sectional design and reliance on self-reported data from a single institution, the findings should be interpreted with caution and should not be construed as evidence of causal relationships. Therefore, future research should incorporate objective academic indicators and longitudinal or experimental designs to further clarify the relationships among these variables.

Notes

Author contributions

The author fully participated in the work performed and documented truthfully.

Conflicts of interest

The author declared no conflicts of interest.

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Ethical statement

This study was approved by the Institutional Review Board of Sahmyook Health University (IRB No. 2-70094958-A-N-01-250515-HR-010-01).

Data availability

The datasets generated during the current study are available from the corresponding author upon request.

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Not applicable.

Use of artificial intelligence (AI) tools and software

The author used Microsoft Copilot for language editing and manuscript refinement. All interpretations, analyses, and final content were reviewed and approved by the author.

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생성형 AI 학습 활용과 치위생과 학생의 인지된 학습 성취도 및 학습 윤리 인식 간의 관련성

초록

목적: 본 연구는 치위생학과 학생을 대상으로 생성형 AI 기반 학습 활용, 인지된 학업성취도 및 학업 윤리 인식 간의 관련성을 조사했다. **방법:** 138명의 학생을 대상으로 구조화된 설문지를 활용한 단면 조사를 했다. 자료는 독립표본 t-검정, 일원분산분석(ANOVA), 피어슨 상관분석, 계층적 다중회귀분석을 통해 분석되었다. **결과:** 생성형 AI 학습 활용도는 인지된 학업 성취도와 유의한 관련성을 보였다(B=1.016, 95% CI: 0.912 to 1.120, p<0.001). 반면, 생성형 AI 활용은 학업 윤리 인식과 유의미한 관련성을 보이지 않았다(B=−0.026, 95% CI: −0.154 to 0.101, p>0.05). 반면, 전공 만족도가 학업 윤리 인식과 유의미한 관련성을 보였다(B=0.179, 95% CI: 0.073 to 0.285, p<0.01). **결론:** 생성형 AI의 활용은 인지된 학업성취도와 유의한 양의 관련성을 보였으나, 학업 윤리 인식과는 유의한 관련성을 보이지 않았다. 반면에 학업 윤리 인식은 전공 만족도와 유의하게 관련되어 있었다. 본 연구 결과는 단면 연구 설계에 기반하므로 변수 간 관계는 인과관계가 아닌 관련성 수준에서 해석되어야 한다.

주요어: 학업성취도, 치위생과 학생, 생성형 인공지능, 고등교육, 학업 윤리

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