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Artificial intelligence (AI) knowledge generation between acceptance and rejection as a tool to enhance project based learning and professors' performance in private higher education sector in Egypt

Articles – Full text

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Abstract

This study aims to test the effectiveness of AI (Artificial Intelligence), which took a new turn after ChatGPT as a tool for the social sustainability of academics in the Egyptian private higher education sector. Digitalization reflects the intensity of artificial intelligence usage in enhancing the performance of professors and its reflection on their quality of life. Moreover, the degree of facilitation and progress can provide educators with the best educational experience they can provide to students.

This study relies on two theories and their backgrounds. The first is the theory of project-based learning as a tool for enhancing the quality of education using AI. The second is Martec's Law, which is a derivation of the law of accelerating returns.

Two main assumptions are addressed in this study, the first is: Using artificial intelligence as a tool that can facilitate, enhance, and provide a variety of ways for professors to engage their students online and in class.
The second is based on measuring the degree of effectiveness and performance advancement seen by professors in their social sustainability.
Enhanced experience of the students will be measured by their rates of attendance and engagement. The amount of impact on project-based learning is going to be measured by the degree of reliance of professors on digital learning methods and their reliance on using artificial intelligence in constructing them. Data will be provided by professors through a constructed survey.
The professor's social sustainability will be measured by quality time saved and related career advancement.
Data collection depends on testing faculty members at 4 private universities in the greater Cairo area. A cross-sectional survey was conducted on a single shot in time.
Results showed that we accepted the hypotheses and that there is a strong relevance between the variables.

Keywords
Artificial intelligence, Education, Performance, Time management, Social Sustainability

Introduction

The industrial revolution is not only relatable to production and physical productivity but also to how it could facilitate the process of performance. Educational organizations are among those facilities that are adapting to a changing environment where they are trying to achieve efficiency while reducing working time. Professors are among the groups that we can call affected and engaged stakeholders by these advancements.

According to (Mathur et al. 2008) stakeholders' engagement is critical and important to policy making and planning, where transparency related to information and getting their consultation and feedback is important to organizations and projects. Where (Eskerod, 2020) argued that aligning stakeholders' personal passions and corporate purpose is crucial for their

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engagement. However, the utilization of stakeholders is important as well, and here comes the role of digitization.

In his work (Fan et al., 2022) digital platforms allow the engagement of all stakeholders in a more modern way. It also facilitates their participation in more complex decision-making processes. The work of (Sachs & Kujala, 2021) agrees that improving the ability of stakeholders to communicate by effectively engaging them with digital technologies adds to a more effective decision-making process. Their engagement is also critical in managing risks associated with using digital technologies and establishing clearer objectives.

In this paper, we are going to test the argument of University professors in achieving the best performance while engaging in such technological advancements.

Methodology:

According to (Topol, 2019) artificial intelligence is designed to artificially imitate human-like behavior in big machines. This leads us to the study of Chang et al., 2022 and their argument that the use of technology greatly affects cognitive ability in education and solving more complex problems. It also, allows students to develop a better reflection of the world through analytical evaluation of given information and better assess arguments.

The work of (Kasneci et al., 2023) in building large language models that are also relatable to personalized learning experiences and testing their impact on teachers and learners. They tackled different educational levels as well. Elementary, middle, and high school, university level, and professional training. The specialized part related to this paper is that their findings proved that the application of these models has positively impacted student's research and writing skills, as well as their creative and thinking abilities.

This paper is built on two frameworks:

The first one in Fig. 1 is related to the work of (Selenko et al., 2022) this study made an argument that the use of AI will enhance the social aspect of the employee life and how it will affect individual well-being and better work-related attitudes and better behavior towards society. The study showcased a very important

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aspect of how the worker perceives AI integration as a threat or tool and this psychological impact. I also, introduced two notions: AI as a replacement for the human factor and AI as an enhancement to the human factor in this paper we will take the aspect of AI as an enhancement to the human factor.

The other aspect depends on the work of (Rosiński, 2023) where he depended on Moore's law and its derivation Martec's law where the argument depended on Fig. 2:

Here (Rosiński, 2023) is showing "It is easier to understand the scale of the changes of the Fourth Industrial Revolution and its impact on society when we overlay the graphs on each other. Moore's law seems to describe an exponential fragment of the S-curve by H. Altszuler. On the other hand, the digitization of subsequent areas of social life causes them to begin to change at an exponential pace (Kurzweil's law of accelerated development), not linear. In addition, we are dealing with a kind of overlap and mutual reinforcement of coexisting, exponential increases as described."

Moreover, the description of Martec's law in Fig. 3 is much more evident in the following diagram:

But what is Martec's Law? According to Brinker S. (2024), Martec's law defines how technology contributes to organizational change. This concept has been adopted in marketing research (Purcărea T., 2019) and the healthcare system by Charow et al. (2021). In both papers, the researchers argued the impact of introducing technology on an organization's business model. Fig. 4 has been adopted in both studies.

The importance and addition of this study depends on three pillars:

Conceptual aspect: these laws have not yet been tested using education facilities as organizations.

Application aspect: Professors' application is lacking, and this is part of the research gap of the study.

Novelty aspect: combining the technological aspect and the sustainability model is new and has not been tested before especially in the educational sector.

This leads us to the conceptual model of the study in Fig. 5:

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This study will rely mainly on two theories and their backgrounds. The first one is the theory of project-based learning as a tool for enhancing the quality of education by using AI. The second is Matrec's Law, which is a derivation of the law of accelerating returns.

The study aims to address two main assumptions: the first assumption is that artificial intelligence is a tool that can facilitate, enhance, and provide a variety of ways for professors to engage their students online and in class. Then:

H_1: There is a positive correlation between using artificial intelligence illustration methods by professors and the enhanced educational experience for students.

Where we are testing the social sustainability of the professor from a career perspective.

The second assumption will be based on measuring the degree of effectiveness and performance advancement seen by professors in their social sustainability. Then:

H_2: There is a positive correlation between using artificial intelligence tools and professor's efficiency in time management.

H_3: There is a positive correlation between using artificial intelligence tools and professor's overall performance rates.

For the study, the enhanced experience of the students will be measured by their rates of attendance and engagement. The amount of impact on project-based learning is going to be measured by the degree of reliance of professors on digital learning methods and their reliance on using artificial intelligence in constructing them. The data will be provided by professors through a constructed survey. Based on the theories and framework, a survey has been constructed to test the effect of the independent over the dependent. The survey was composed of 19 questions where 3 of them were open-ended, 13 were 5-point Likert style, and 2 dichotomous questions.

To test AI on academic performance: 6 closed-end questions were allocated and one open-end.

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To test AI on Time management: 6 open-ended questions were allocated and one open-ended question.

To test AI on Enhanced Educational Experience 4 closed-end questions were allocated and one open-end question.

To test the overall AI importance: 2 closed-end questions were allocated and one open-end question.

There is a relationship to be tested between Enhanced Educational Experience and overall, AI importance.

Population and Sampling:

Private universities in eastern Cairo. Only 4 universities were under investigation. All schools were considered. The average number of Faculty members in 4 universities is around 150 professors and teaching assistants. The population has been calculated using either university website data or by directly contacting the Human Resources Department of the university. The sample that could have been reached and completed the survey was 42 respondents.

Validity and Reliability:

According to Leven's test (used to test the reliability and validity of variables) in Fig. 6, the error variance of the dependent variables is equal across groups, which means that the effect of AI is equal for all the dependent variables so that all the dependent variables are affected equally when using AI.

Results and Discussion:

Fig. 7 represents the analysis of the general linear model and describes the relationship between overall AI performance and academic performance, time management, and enhanced educational experience.

The results of the multivariate test in Fig. 8 show that the AI Group significance is 0.010 which is less than 0.05 (significance level) which measures the effect of AI on overall performance, academic performance, time management, and enhanced educational experience. Therefore, H1 is accepted. In other words, AI significantly affects professors' human performance.

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The results of tests of equality of covariance in Fig. 8 also proved that AI has an equal effect on each of the variables as the significance is 0.297 which is greater than 0.005. Therefore, the results accept H2 and H3 which assume that AI equally affects the dependent variables (human performance) Fig. 9.

In general, the results of the research accept the hypothesis that AI affects the instructors' performance, while the null hypothesis is rejected.

Open-end questions align with the qualitative results where most of the answers were in favor of using AI as an enhancement tool and its adoption is reflected positively in social sustainability and enhancing performance levels.

Conclusion:

The results align with the mentioned literature regarding engagement and social sustainability. This study proved that Martec's law is applicable in an intangible service like the education sector. More research is advisable with experimental measures for further enhancements.

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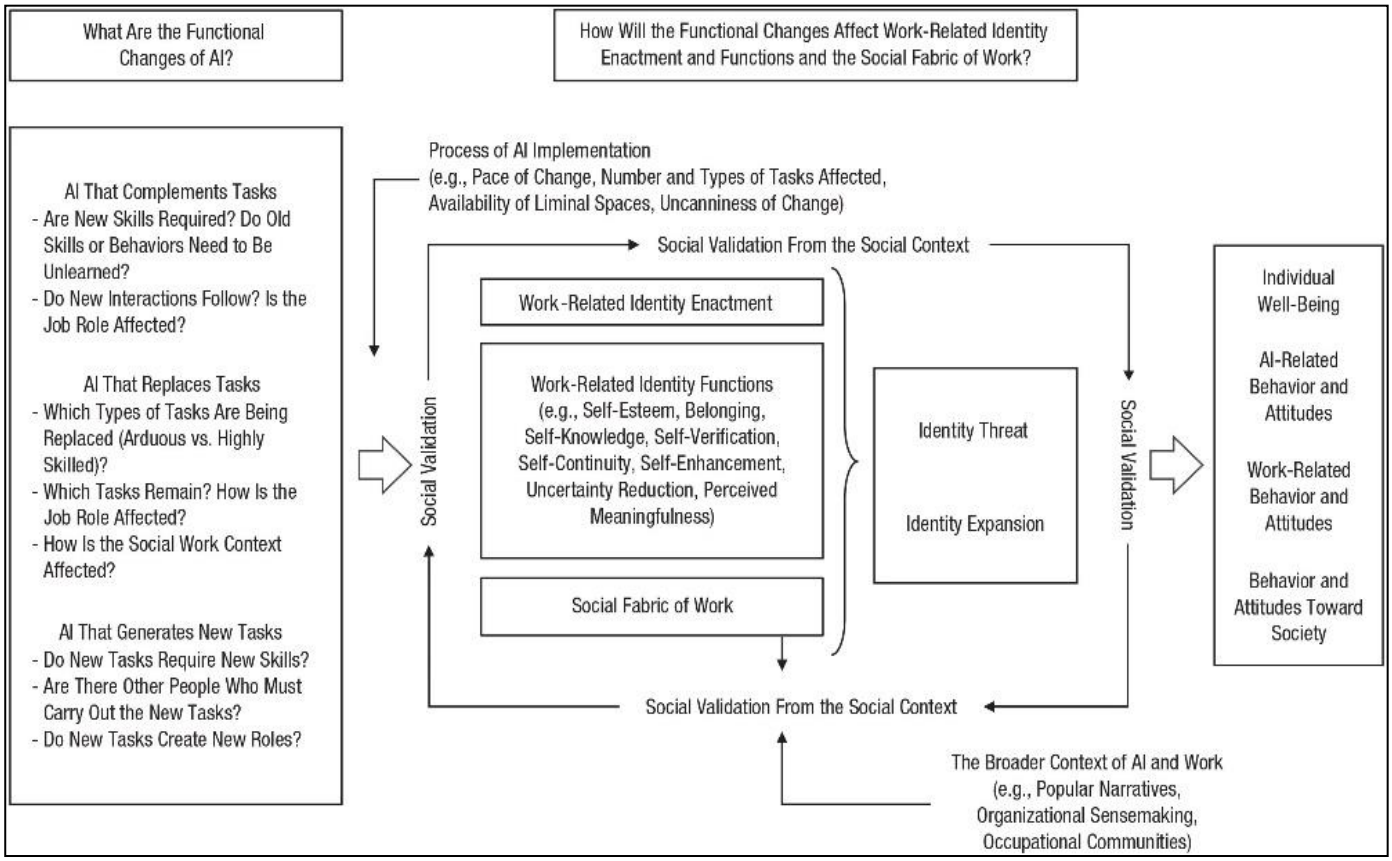

Fig. 1: Impact of AI on employees. (Selenko et al., 2022)

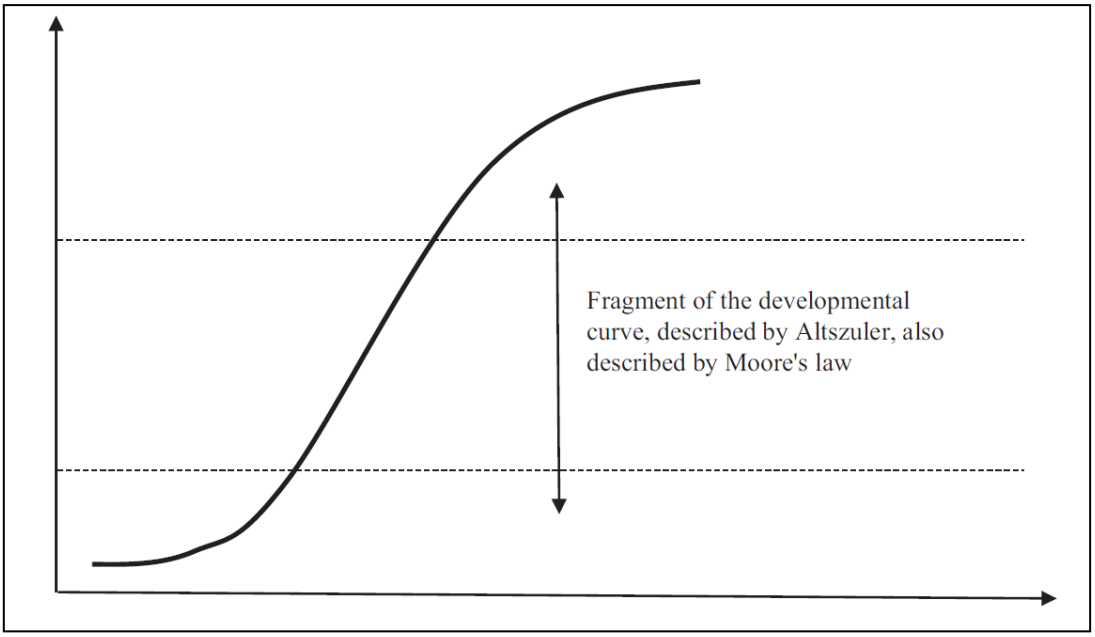

Fig.2: Common parts of Altzur's and Moor's Law. (Rosiński, 2023)

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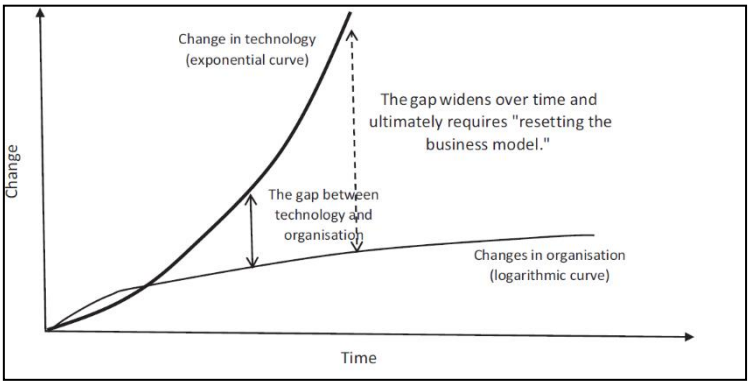

Fig. 3: Chart describing Martec's Law. (Rosiński, 2023)

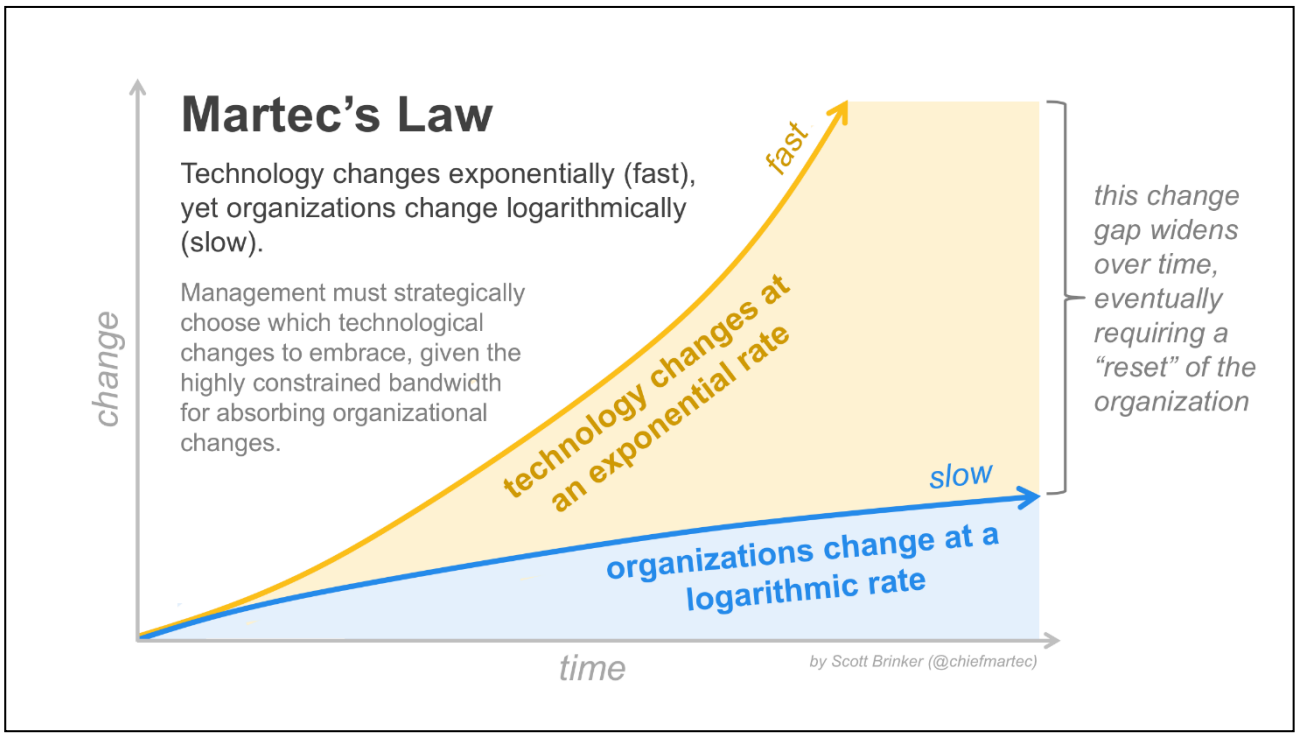

Fig. 4: Matrec's Law. (Brinker S., 2016) retrieved from (Wiljer & Hakim, 2019)

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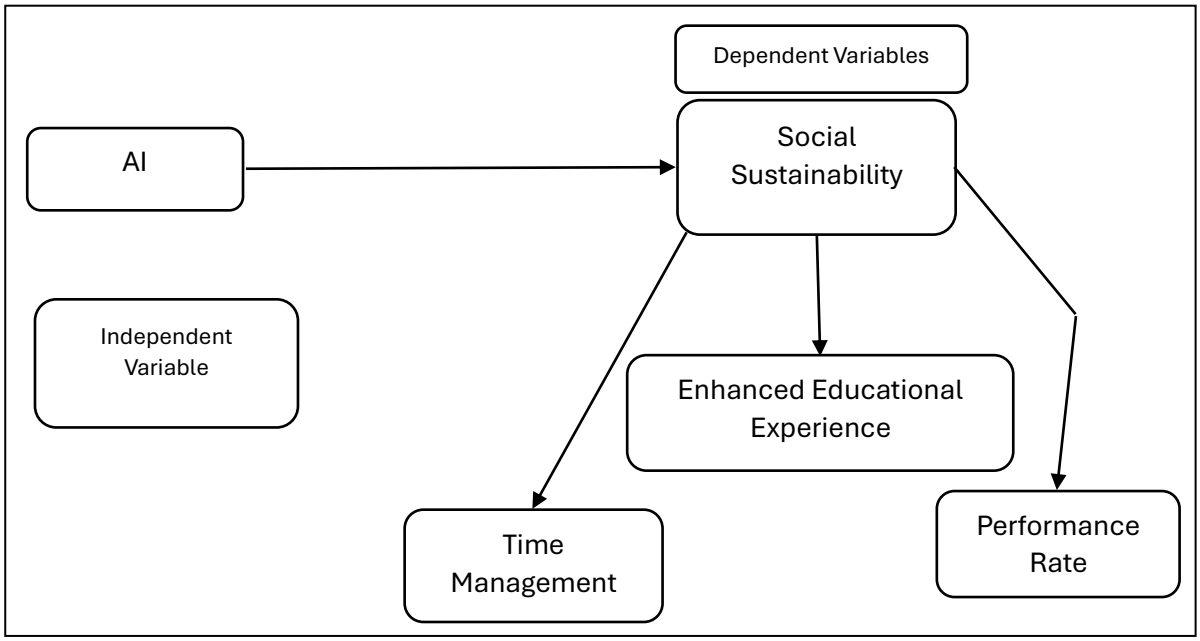

Fig. 5: Combining technological aspect and sustainability model

Levene's Test of Equality of Error Variances[a]

	F	df1	df2	Sig.
Overall_AI_performance	.004	1	40	.950
Academic_performance	.275	1	40	.603
Time_management	.014	1	40	.906
Enhanced_educational_experience	.013	1	40	.909

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + AI_group

Fig. 6: Leven's test of equality among dependent variables

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```
GLM Overall_AI_performance Academic_performance Time_management Enhanced_educational_experience BY
    AI_group
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /PRINT=DESCRIPTIVE ETASQ OPOWER HOMOGENEITY
  /CRITERIA=ALPHA(.05)
  /DESIGN= AI_group.
```

General Linear Model

Between-Subjects Factors

		Value Label	N
AI intervention group	1	AI	7
	2	NO AI	35

Descriptive Statistics

	AI intervention group	Mean	Std. Deviation	N
Overall_AI_performance	AI	7.29	2.215	7
	NO AI	7.51	1.738	35
	Total	7.48	1.798	42
Academic_performance	AI	21.0000	5.03322	7
	NO AI	21.8286	3.68212	35
	Total	21.6905	3.87920	42
Time_management	AI	21.8571	4.14039	7
	NO AI	20.6286	4.04450	35
	Total	20.8333	4.03592	42
Enhanced_educational_experience	AI	17.2857	2.13809	7
	NO AI	15.5714	2.22665	35
	Total	15.8571	2.28005	42

Fig. 7: General Linear Model

Box's Test of Equality of Covariance Matrices[a]

Box's M	16.148
F	1.187
df1	10
df2	501.581
Sig.	.297

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + AI_group

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
Intercept	Pillai's Trace	.970	304.117[b]	4.000	37.000	.000	.970	1216.469	1.000
	Wilks' Lambda	.030	304.117[b]	4.000	37.000	.000	.970	1216.469	1.000
	Hotelling's Trace	32.878	304.117[b]	4.000	37.000	.000	.970	1216.469	1.000
	Roy's Largest Root	32.878	304.117[b]	4.000	37.000	.000	.970	1216.469	1.000
AI_group	Pillai's Trace	.295	3.868[b]	4.000	37.000	.010	.295	15.470	.856
	Wilks' Lambda	.705	3.868[b]	4.000	37.000	.010	.295	15.470	.856
	Hotelling's Trace	.418	3.868[b]	4.000	37.000	.010	.295	15.470	.856
	Roy's Largest Root	.418	3.868[b]	4.000	37.000	.010	.295	15.470	.856

a. Design: Intercept + AI_group

b. Exact statistic

c. Computed using alpha =

Fig. 8: Test of equality of covariance and Multivariate test

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Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[e]
Corrected Model	Overall_AI_performance	.305[a]	1	.305	.092	.763	.002	.092	.060
	Academic_performance	4.005[b]	1	4.005	.261	.612	.006	.261	.079
	Time_management	8.805[c]	1	8.805	.534	.469	.013	.534	.110
	Enhanced_educational_experience	17.143[d]	1	17.143	3.499	.069	.080	3.499	.447
Intercept	Overall_AI_performance	1277.733	1	1277.733	386.690	.000	.906	386.690	1.000
	Academic_performance	10700.005	1	10700.005	698.238	.000	.946	698.238	1.000
	Time_management	10529.376	1	10529.376	639.085	.000	.941	639.085	1.000
	Enhanced_educational_experience	6297.619	1	6297.619	1285.228	.000	.970	1285.228	1.000
AI_group	Overall_AI_performance	.305	1	.305	.092	.763	.002	.092	.060
	Academic_performance	4.005	1	4.005	.261	.612	.006	.261	.079
	Time_management	8.805	1	8.805	.534	.469	.013	.534	.110
	Enhanced_educational_experience	17.143	1	17.143	3.499	.069	.080	3.499	.447
Error	Overall_AI_performance	132.171	40	3.304					
	Academic_performance	612.971	40	15.324					
	Time_management	659.029	40	16.476					
	Enhanced_educational_experience	196.000	40	4.900					

Fig. 9: Test between subject effects

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