

Investigation of the Effects of Creative Imagination on Academic Outcomes in Design Programs

Yuvraj Parmar¹, Dr. Amit Kumar Shrivastav², Dr. Anand Kopare³, Ankit Sachdeva⁴, Sunil MP⁵, Shubhi Goyal⁶, Tushar Pradhan⁷

¹Chitkara Centre for Research and Development, Chitkara University, Himachal Pradesh, India, yuvraj.parmar.orp@chitkara.edu.in

²Registrar, Office of Registrar, ARKA JAIN University, India, amit.s@arkajainuniversity.ac.in

³Associate Professor, Department of ISME, ATLAS SkillTech University, India, anand.kopare@atasuniversity.edu.in

⁴Centre of Research Impact and Outcome, Chitkara University, Rajpura, Punjab, India, ankit.sachdeva.orp@chitkara.edu.in

⁵Assistant Professor - 3, Department of Electronics and Communication Engineering, Faculty of Engineering and Technology, JAIN (Deemed-to-be University), India, mp.sunil@jainuniversity.ac.in

⁶Quantum University Research Center, Quantum University, India. shubhi.mathematics@quantumeducation.in

⁷Assistant Professor, Parul Institute of Management and Research-MBA, Parul University, Vadodara, Gujarat, India, tushar.pradhan@paruluniversity.ac.in

Abstracts

Imagination as the key to the creative process is one of the key components of design education that affects students' problem-solving skills and innovation. The purpose of this research is to determine the impact of creative imagination on the academic performance of students enrolled in design courses. It intends to obtain a measure of the way creative imagination affects or influences students' performance as well as their achievements. However, there is a lack of understanding regarding the correlation between creativity and performance among university students. The study collected data on creative imagination and academic performance through a survey of 350 participants drawn from five universities. Self-administered questionnaires were distributed to 350 participants, of which 320 were 176 males and 144 females. The research included quantitative techniques such as linear regression, correlation analysis, and structural equation modeling-partial least squares (SEM-PLS). Further, the result of the analysis showed that imagination level has the most significant impact on academic outcomes in design programs with a strong positive effect ($\beta=0.35$, $p\text{-value} = 0.04$). Higher creative imagination scores had a positive correlation with grades and students' involvement. This underscores the importance of forecasting to enhance students' performance and engagement in design programs. The strategies used in education should be utilized to supplement creativity to raise

the performance and satisfaction of students.

Keywords: creative imagination, academic performance, problem-solving skills, design programs, student involvement.

Introduction

In contemporary society and learning institutions, creativity has emerged as one of the most significantly valued skills as indicated in the design field [6]. Creativity is important for designing new solutions and efficient strategies which is why colleges and universities pay much attention to this aspect [15]. With the development of information technologies and the appearance of new topics students can think creatively being prepared for tough academic and further careers [10]. In design programs there is always a high emphasis put on students' creativity and how they would approach problems [2]. This emphasis on creative thinking is to equip the students with analytical thinking skills that are highly desirable in the workplace.

However, it is often difficult to determine how creativity may affect academic performance in detail like the grades and quality of a subsequent project [12]. To gain a more coherent understanding of the link between creativity and academic performance, to present some observations on how design educators can facilitate students' creative potentiality [11]. It is desirable to comprehend these dynamics if one is to design the most appropriate processes through which creativity could be fostered within a classroom environment and consequently, students' performances enhanced [7]. Such knowledge assists designers in developing settings and cultures where students foster innovation, thus significantly enhancing their performance.

The study goal is to investigate how imagination influences academic achievement in design program. It seeks to determine which aspect of creative thinking has the biggest effect on students' academic performance.

The Organization of research as follow: Related articles are discussed in section 2; methodology is detailed in section 3; statistical analysis presented in section 4; discussion covered in section 5; and conclusion along with limitation and future scope are provided in section 6.

Related articles

Three areas of research were examined in [9], the fields were: (a) the relationship between graduation grades and creative first-year engineering students; (b) the effect of gender on imaginative ability; and (c) the evolution of imagination throughout four years in college. It also investigates the relationship between first-year engineering students' creative potential and their final-year marks in non-major liberal arts classes. 57 students from a Korean engineering institution participated in the exploratory project. In August 2013, the initial set of data was gathered from ninety fresher engineering students. The results of the study suggested that adults might still have creative potential.

The article [8] investigated the impact of national entrance examinations on university students' creative talents using Guilford's theories on creativity, proficiency, adaptability, clarification, interest, and divergent thought. Several Turkish universities had their student submissions re-evaluated by a professor between 2018 and 2020. The results showed that although students taking the national entrance test exhibit greater diversified cognitive processes than students taking aptitude examinations, they were also less creative, inventive, fluent, inquisitive, and adaptable.

The purpose of the study was to enquire at how grouping affected 87 students' academic performance and artistic creativity. The hypothesis of the study [14] was that attendance at Center for Educational Programs and Artistic Creativity (CEPAC) was associated with improvements in creativity and academic achievement. The research took into account the overall average after the 2019 school year, scores in mathematics and Spanish, and results from The Children and Young People's Creative Imagination Test. The findings indicated that academic performance and certain creative components improved when students were grouped according to ability.

In educational environments, the study [1] examined at how creativity affected students' academic achievement. The Education Resources Information Centre (ERIC), SCOPUS, and the Database were used to analyse data from 2005 to 2022. The meta-analysis was restricted to the papers that made their variable correlation coefficients public. According to the effect size classification, the overall effect size of the results was 619, indicating a medium-sized influence.

Examined how imagination influences students' academic performance in learning environments was the goal of the study [3]. The Database, ERIC, and SCOPUS information were used to examine data from 2005 to 2022. Only the publications that disclosed their variable correlation coefficients to the public were included in the meta-analysis. The overall impact size of the results was 619, which indicates a medium-sized influence based on the effect size categorization.

The study [4] aimed to measure the degree of creativity among dental students, and ascertain whether Guilford's theories on creativity, proficiency, adaptability, clarification, interest, and divergent thought. The dentistry students' level of creativity was assessed by questionnaires, and connections with their academic and clinical performance were subsequently made. There was no discernible relationship between any doctor's clinical performance and their Big C and Little C originality, with Pearson correlation values.

With a focus on business graduates from the Institute of Information Technology in Islamabad, the study [13] examined the relationship between academic accomplishment (CGPA) and emotional intelligence and creativity. The Wong and Law Emotional Intelligence Scale (WLEIS), the Nicolas Holt Creativity Test (NHCT), and the Cumulative Grade Point Average (CGPA) Information Format were The three instruments employed for data collection on academic achievements, emotional quotient, and creativity. The findings showed that pupils' academic success was predicted by both Emotional Quotient (EQ) and creativity.

Hypothesis development

H1: Imagination Level → Academic Outcome

✚ Higher Imagination Level (IL) is connected with higher academic outcomes (AO) in design programs.

H2: Design Educational Framework → Academic Outcome

✚ Students enrolling in the Design Educational Framework (DEF), which contains courses that promote creativity, will have a higher Academic Outcome (AO) than those in standard design programs.

H3: Teaching Approach → Academic Outcome

✚ Students taught using Teaching approaches (TA) will display greater academic outcomes (AO) than those taught using lecture-based methods, due to enhanced chances for creative expression.

H4: Student Involvement → Academic Outcome

✚ Increased student involvement (SI) in design courses and activities is associated with improved academic outcomes (AO).

H5: Extracurricular Activities → Academic Outcome (AO)

✚ Students who actively participate in design-related extracurricular activities (EA) will demonstrate better academic Outcomes (AO) compared to those who do not participate.

H6: Creative Level → Creative Confidence → Academic Outcome (AO)

✚ The relationship between creative Level (CL) and academic Outcome (AO) is mediated by creative confidence (CC), such that higher creative imagination leads to increased creative confidence, which in turn enhances the academic outcome.

Methodology

Fig 1 illustrates a visual representation of the relationship between creative imagination and academic outcome. The study identifies independent variables are Imagination Level (IL), Design Educational Framework (DEF), Teaching Approaches (TA), Student Involvement (SI), and Extracurricular Activities (EA). The dependent variables include academic outcomes (AO), and creative confidence (CC) serves as a mediating variable, exploring its function in the correlation between creative imagination and academic performance.

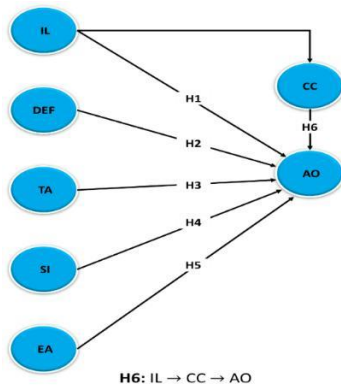


Fig 1 Research Conceptual model

Participants and procedure

The participants comprised graduate students from five universities, majoring in different disciplines. Out of 350 participants, 320 people responded to all aspects of the research. The sample consisted of 176 males and 144 females, with 126 freshmen, 110 juniors, and 84 seniors. The data was collected systematically following the same procedure in all the universities by trained graduate assistants who underwent 18 hours of training to ensure quality data was collected. It was voluntary, conducted in confidence, and the respondents' identities remained anonymous. Table I demonstrates the participant's profile.

Table I Profile of Participants

Variable	Category	Count	Percentage
Gender	Males	176	55.00%
	Females	144	45.00%
Year in University	Freshmen	126	39.40%
	Juniors	110	34.40%
	Seniors	84	26.30%
Total Respondents		320	100%

Generating question

To gather data for this research, a questionnaire was administered to 350 graduate students from five universities and across different faculties. The questionnaire aimed to evaluate their perceptions areas: Imagination Level (IL), Design Educational Framework (DEF), Teaching approaches (TA), student engagement (SI), Extracurricular activities (EA), academic outcome (AO), and Creative Confidence (CC). Out of 350 questionnaires, 320 were considered eligible for analysis because of incomplete responses or missing data. Using a 5-point Likert scale, 1

denoted "strongly disagree," and 5 denoted "strongly agree", respondents were asked to score their responses.

Statistical analysis

Structural Equation Modeling with Partial Least Squares (SEM-PLS) is a statistical technique used to analyze complex relationships between variables. It combines aspects of both factor analysis and multiple regression. Data analysis was made using SPSS version 17. To investigate the effects of creative imagination on academic outcomes in design programs, utilizing linear regression to assess the relationship between imagination and performance, and correlation analysis to investigate the strength and direction of the relationship and compare academic outcomes across different levels of creative imagination.

Result

This results section investigates the variables that influence academic success in design programs, with a focus on the impact of creative imagination. The study uses SEM-PLS, linear regression, and correlation analysis to demonstrate how creative imagination influences academic success. It also investigates the contributions of other aspects, such as the design of educational framework, teaching approach, extracurricular activities, and creative confidence, emphasizing their importance in improving students' academic performance in design fields. Table II shows the SEM-PLS analysis of the factor.

Table II SEM-PLS analysis of factors influencing academic outcome					
Latent Variable	Items	Loading	Alpha (α)	Composite Reliability (CR)	AVE
Imagination Level (IL)	IL1	0.85	0.91	0.93	0.70
	IL2	0.87			
	IL3	0.84			
Design Educational Framework (DEF)	DEF1	0.78	0.82	0.85	0.60
	DEF2	0.81			
	DEF3	0.76			
Teaching Approaches (TA)	TA1	0.74	0.76	0.80	0.52
	TA2	0.77			
	TA3	0.73			
Student Involvement (SI)	SI1	0.70	0.72	0.76	0.50
	SI2	0.72			
	SI3	0.68			
Extracurricular Activities (EA)	EA1	0.73	0.74	0.78	0.52
	EA2	0.76			
	EA3	0.7			
Academic Outcome (AO)	AO1	0.78	0.79	0.83	0.55
	AO2	0.80			
	AO3	0.75			
Creative Confidence (CC)	CC1	0.76	0.75	0.80	0.52
	CC2	0.78			
	CC3	0.74			

The table displays the measurement properties of latent variables in a study, demonstrating that Imagination Level (IL) has the highest loading (0.85, 0.87, 0.84) with strong alpha (α) (0.91) and composite reliability (0.93), indicating excellent internal consistency and reliability, and an average variance extracted (AVE) of 0.70, indicating good construct validity. The high values indicate that IL is a powerful predictor, owing to its consistent performance across items and considerable influence on academic achievement. Other variables, such as DEF, TA, and SI, also demonstrate strong reliability, but with slightly lower scores than IL.

Linear regression

Multiple regression is an extension of simple regression used in investigating the degree and nature of the linear relationship between a dependent variable and two or more independent variables.

Table III Linear regression evaluation

Predicted variable	Coefficient (β)	Standard error (SE)	t-value	p-value
Imagination Level (IL)	0.35	0.12	2.92	0.04
Design Educational Framework (DEF)	0.25	0.1	2.5	0.003
Teaching Approaches (TA)	0.30	0.09	3.33	0.007
Student Involvement (SI)	0.20	0.11	1.82	0.045
Extracurricular Activities (EA)	0.28	0.08	3.5	0.003
Academic Outcome (AO)	0.32	0.11	2.91	0.003
Creative Confidence (CC)	0.40	0.14	2.86	0.045

In Table III, Creative Imagination has the highest positive impact on academic achievement in design programs ($\beta = 0.35$, $p = 0.04$). This is because imagination creates opportunities for creative thinking, problem-solving, or creating unique ideas that are of the essence to the design. Other parameters include Design Educational Framework ($\beta = 0.25$, $p = 0.003$), Teaching approach ($\beta = 0.30$, $p = 0.007$), Extracurricular Activities ($\beta = 0.28$, $p = 0.003$) whose impact in the same order is not as significant as that of academic Outcome. Remarkably, Student Involvement ($\beta = 0.20$, $p = 0.045$) and Creative Confidence ($\beta = 0.40$, $p = 0.045$) have a supportive character. However, it also revealed that the development of imagination directly affects academic performance in design programs and thus could be considered a primary leading factor. The evaluation of linear regression is as follows which is described in the table below Table III.

Correlation analysis

Correlation analysis measures the strength and direction of the linear relationship between two variables, providing insight into how changes in one variable are associated with changes in another. The table shows Imagination Level (IL) with the highest correlation coefficient of 1.00, indicating it is the most significant variable among the others. Table IV illustrates the correlation analysis.

Table IV The correlation analysis

Variable	IL	DEF	TA	SI	EA	AO	CC
Imagination Level (IL)	1.00	0.45	0.32	0.55	0.4	0.6	0.7
Design Educational Framework (DEF)	-	1.00	0.5	0.38	0.42	0.54	0.61
Teaching Approaches (TA)	-	-	1.00	0.29	0.35	0.47	0.53
Student Involvement (SI)	-	-	-	1.00	0.46	0.57	0.64
Extracurricular Activities (EA)	-	-	-	-	1.00	0.5	0.56
Academic Outcome (AO)	-	-	-	-	-	1.00	0.65
Creative Confidence (CC)	-	-	-	-	-	-	1.00

The correlation table displays the links between major variables that influence academic success in design programs. Imagination Level (IL) correlates strongly with other factors, notably Creative Confidence (CC) (0.7) and Academic Outcome (AO) (0.6), since it directly encourages creative thinking and problem-solving, both of which are required for success in design programs. This substantial association demonstrates IL's critical role in promoting innovation and academic success.

Model framework

This table summarises the findings of hypothesis testing in research that examined the influence of several variables on academic outcomes. Each hypothesis analyses the strength of the association between the variables. The β value shows the impact size, R^2 reflects the proportion of variance explained, f^2 quantifies the effect size of predictors, and p-values determine statistical significance. Hypotheses with lower p-values are seen as more significant, with H1 indicating the greatest importance for Imagination Level influencing academic results. Table V and Fig 2 representation structural framework.

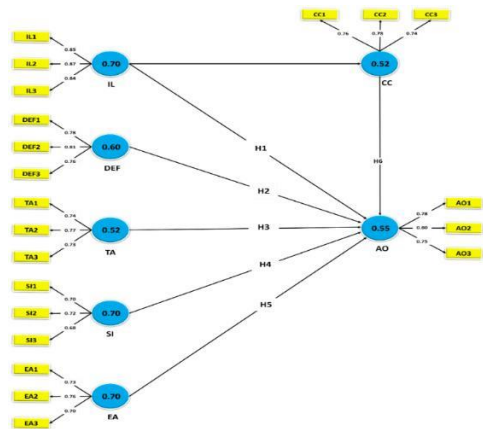


Fig 2 Visual representation of the structural model

Table V structural framework

Hypothesis	Connection	β value	R^2	f^2	p-values	Result
H1	(IL)→(AO)	0.35	0.12	0.4	0.04	High Significant
H2	(DEF)→(AO)	0.25	0.08	0.29	0.003	Significant
H3	(TA)→(AO)	0.3	0.09	0.07	0.007	Significant
H4	(SI)→(AO)	0.2	0.04	0.21	0.045	Significant
H5	(EA)→(AO)	0.28	0.08	0.3	0.003	Significant
H6	(CI)→(CC)→(AO)	0.72	0.16	0.50	0.020	Significant

Discussion

The results of the SEM-PLS analysis demonstrate that among the factors Imagination Level (IL) with $\beta = 0.35$ has the highest impact on Academic Outcome (AO) in design programs and also the p-value is < 0.04 . It was also significant at $P < 0.0004$, which validates with the inferences made from the earlier which showed that it was highly significant. This implies that imagination is highly effective in empowering creativity and innovative expertise that is significant to design. Design Educational Framework (DEF) and Teaching Approaches (TA) also emerge with considerable influence on AO ($\beta = 0.25$, $p = 0.003$ & $\beta = 0.30$, $p = 0.007$ respectively) but lesser to a certain extent. Extracurricular Activities (EA) ($\beta = 0.28$, $p = 0.003$) and Creative Confidence (CC) ($\beta = 0.40$, $p = 0.045$) are some of them significantly included in the model but to a lesser extent. The Student Involvement (SI) has a supportive role ($\beta = 0.20$, $p = 0.045$). Thus, further correlation analysis proves IL is highly correlated to AO with IL integrating the greatest correlation coefficients to all of the variables. Collectively, these results highlight the significance of creative imagination as the main factor that can be leveraged to boost academic achievement in design courses.

Conclusion

The study establishes creative imagination as the key factor in improving the academic performance of students, especially in design-related courses. The participants in the study comprised 320 students from five universities, and the findings depict a high positive correlation between the scores of imagination level and academic performance with significant $\beta = 0.35$, and a p-value = 0.04. This means that a higher level of creative imagination correlates with enhanced performance and student engagement. Therefore, the study underscores the need for design programs to incorporate innovative approaches in design education to improve students' performance and increase their satisfaction. Based on the findings, it has been recommended that educational practices should foster creativity to enhance academic performance and participation in design courses.

Limitation and future scope

The study's sample was limited to students from specific design programs, which may affect the generalizability of the findings to other fields or educational contexts. Future research could explore the impact of creative imagination on academic outcomes across diverse disciplines and

educational levels, and investigate interventions to enhance imaginative skills in various learning environments.

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