



Research Paper

## Dependence of Students on Chat Bots and Their Relationship with Their Divergent Thinking

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### Abstract

The present study highlights the dependence of students on chat bots (CB) and its relationship with their divergent thinking. A sample of 92 high school students of tri-city of Chandigarh was taken for the study. The data was collected using the self constructed scales relating to dependence on chat bots and divergent thinking. The raw data was subjected to descriptive and inferential statistics. The coefficient of correlation and t-ratio values were computed to see the relationship between dependence on chat bot and divergent thinking and the difference between girls and boys relating to the said variables. The results of the study showed that the dependence on CB in total and its components separately have no relationship with divergent thinking for high school students of tri-city of Chandigarh. Even high school girls and boys do not show any significant difference in dependence on CB in total and their components separately and even in their divergent thinking.

**Keywords:** Dependence on Chat bots, divergent thinking, usage, habituation, satisfaction, credibility

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### I. Introduction

Chat bots (CB) are artificial intelligence applications that use natural language processing (NLP) algorithms to understand the user's queries and then respond to them in a manner that resembles human conversation. The main objective is to make the communication more interactive. Chat bots use NLP to interpret and understand the context and intent behind the queries or messages and then respond in a manner that a human would do in a given situation. In the era of social media CB have emerged as an alternative to engagement they are designed to cater to the individual needs of communication and social belonging (Lin, Huang, and Yang, 2023). These can be used both for routine work like making reservations and handling transactions or specific tasks to automate a given process. CB have a wide variety of uses in many different areas such as customer support, health care, human resources, and education.

In education, chat bots can increase efficiency and connectivity and reduce uncertainty in interactions. It can provide a personalized learning environment to the students. It can develop their interaction skills and also help the teaching faculty by bringing automation. Chat bots are interactive so can be used as virtual assistants (Chinedu and Ade-Ibijola, 2021). In education, the assistant can help with various things and processes related to education. Unlike conventional teaching methods, chat bots provide a personalized and responsive approach to education, catering to the individual needs of students. With the ability to engage in natural language conversations, these virtual assistants have the potential to create dynamic and interactive learning environments. From answering queries and providing instant feedback to guiding students through coursework, chat bots offer a range of functionalities that can significantly contribute to the efficiency and effectiveness of educational processes.

Students can have interactive conversations with the chat bots, can access intriguing information, investigate new topics and collect information or content for their projects. It can provide immediate assistance when students are struggling with a particular concept or topic. It can customize the content for the students.

By using chat bots even teachers can enhance their efficiency, create a more personalized learning experience for their students and strengthen communication with students, parents and colleagues. It can act as a valuable tool to support and augment the teaching-learning process.

They can aid the teacher in student instruction, paper assessment, curriculum updates etc. Teachers can use chat bots as their assessment assistants for creating and grading assignments. It can also provide regular updates on students' progress and keep the parents informed about their performance. It can also help the teachers to develop professionally by suggesting relevant professional development resources based on their interests and needs.

Chat bots can even help to streamline administrative processes. For various inquiries and data management chat bots can offer time-saving and efficient alternatives. Chat bots can revolutionize the way education is managed.

While there are benefits of using chat bots there are potential drawbacks also. They cannot replace human interaction which is very important in education. Interaction between students and teachers builds strong relationships while it is not possible with machines. The fine nuances of a particular topic cannot be understood without the teacher.

Chat bots work according to the data fed into them. They seem unbiased but if the data fed itself is biased it can have serious implications for students and their learning.

Since chat bots can help students in almost everything from asking questions to making assignments and doing homework, it may make students over dependent on them. This overdependence may hamper their divergent thinking and problem solving ability.

Divergent thinking is open ended thinking where an individual can think of several solutions for a given problem. This kind of thinking helps to produce original and novel ideas. Divergent thinking includes fluency, flexibility, originality and elaboration. Divergent thinking is the ability to generate creative ideas by combining diverse information in novel ways (Guilford, 1967).

Since the use of CB provides the information and content with a single click, it may hinder the development of divergent thinking of students in the long run. So the investigators felt the need to study the relationship between dependence on CB and divergent thinking among high school students.

## **II. Review of literature**

Mukherjee et al. (2023) conducted a research case study with 5 researchers from a large information technology company and 7 university engineering research students that aims to address shortcomings in impact statements by developing a chat bot called ImpactBot. ImpactBot encourages critical thinking in researchers when creating impact statements for research projects or papers. It utilizes fine-tuned ROBERTa models for sequence classification and was tested with researchers from an IT company and university engineering research students. This chat bot can be integrated into content management or paper submission systems to engage researchers in discussions about negative impacts and mitigation strategies in their impact statements.

Annuš, N. (2023) discussed the potential of chat gpt in various educational processes, especially on students and teachers. It discusses that chat gpt can impact students and teachers both positively and negatively. It can enable interactive learning and personalized help for the students. The help is fast and available around the clock. Also chat gpt is a useful tool for improving language skills. But Chat gpt sometimes may provide incomplete or incorrect information. Also, overdependence on it can lead to a loss of critical thinking among the students. Human interaction and personal touch are missing in machines whereas these are very important factors in education. For teachers Chat gpt can produce support material, prepare tests and assignments and also help them as a research tool to expand their knowledge. The chat bots have many advantages but they cannot act as a replacement for human interaction.

Černý M. (2023) conducted research that looks at chat bots in education that don't use artificial intelligence. These chat bots can help reduce feelings of isolation in e-learning. The study involved 79 students and focused on how to design these chat bots to make students happy. It found that students want chat bots to act like humans, but they get confused if the chat bot doesn't understand them. Students in information studies and library science interacted with an information retrieval chat bot and shared their experiences. The goal is to find principles for making chat bots without AI that students can easily interact with.

Vasconcelos and dos Santos (2023) conducted research that explores the use of ChatGPT and Bing Chat, advanced conversational AIs, as tools to promote reflective and critical thinking in STEM education. The research employs a single-case study methodology and analyzes interactions between students and these AI systems during simulated STEM learning experiences. The findings suggest that ChatGPT and Bing Chat can enhance learners' reflective thinking, creativity, problem-solving skills, and concept comprehension. However, the study emphasizes the importance of integrating AI into collaborative learning and addressing concerns related to AI information accuracy, reliability, and reduced human interaction. Finally, the research suggests that

these AI systems have the potential to transform STEM education by fostering engagement in inclusive and accessible learning environments.

Barsoum, Elnagar, and Awad, (2022) conducted an experimental study to research the effectiveness of using cognitive style based chat bots in developing science concepts and critical thinking among preparatory school students. The participants were divided into groups of 25 each according to their cognitive style of tolerance or intolerance of ambiguity. The results showed that there is a positive impact of using a cognitive style chatbot in developing science concepts and critical thinking skills among the students.

Kuhail, et.al (2023) conducted a systematic review of 36 research papers to comprehend and consider current efforts to apply chat bots in education using seven dimensions: educational field, platform, design principles, the role of chat bots, interaction styles, evidence, and limitations. It was thus demonstrated that chat bots were created on a web platform to instruct users on general subjects like computer science, language, general education, and a few other fields such as engineering and mathematics. The chat bots were mainly used for personalized tutoring.

Chinedu and Ade-Ibijola (2021) reviewed 53 studies on the use of chat bots in education. They found that the database of integration of chat bots in education is increasing rapidly and chat bots are used for a wide variety of applications in education such as teaching learning administration research and development etc. Chat bots can be used to deliver instructions to the students and for personalized help in learning. In administration, chat bots generate responses to various queries made by students or parents and even provide feedback. Teachers use chat bots for assessment of students. They even prepare assessment tools using CB. The review also dealt with important questions like challenges faced in implementing and the ethical issues in the implementation of chat bots.

Quirogaetal (2020) conducted a systematic review of 80 selected studies out of 485 sources to examine the role of chat bots in education. The study follows the PRISMA framework and predefined criteria to categorize educational chat bots and their impact on both student learning and service enhancement. The paper also delves into the technology behind these chat bots and their effectiveness in facilitating learning outcomes. It identifies instances where chat bots can replicate human tutor-like interactions and explores diverse techniques for assessing their quality. Ultimately, this comprehensive analysis serves as a valuable resource for the research and development of educational chat bots in the education sector.

### **Objectives**

The following objectives of the study relate to the high school students of tri city of Chandigarh.

1. To study the dependence on chat bots of high school students of the tri-city of Chandigarh.
2. To study the correlation between dependence on chat bots and the divergent thinking of students.
3. To study the correlation between components of dependence on chat bots and the divergent thinking of students.
4. To study the significant difference in dependence on chat bots between girls and boys.
5. To study the significant difference in components in dependence on chat bots between girls and boys.
6. To study the significant difference in divergent thinking between girls and boys.

### **Hypotheses**

1. There is no significant correlation between dependence on chat bots and the divergent thinking of students.
2. There is no significant correlation between components in dependence on chat bots and the divergent thinking of students.
3. There is no significant difference in dependence on chat bots between girls and boys of high schools in Chandigarh.
4. There is no significant difference in components of dependence on chat bots between girls and boys of high schools in Chandigarh.
5. There is no significant difference of the divergent thinking between girls and boys of high schools in Chandigarh.

### **Sample**

High school students of the tri-city of Chandigarh constituted the population of the study. A representative sample of 92 students was taken for research purposes.

### **Tools used**

The following tools were used for the collection of data:

1. Dependence on Chat bots scale constructed by investigators themselves.
2. Divergent thinking scale developed by investigators themselves.

**Procedure and collection of data**

The research was conducted to study the dependence of high school students on chat bots. A descriptive survey method has been used to study the problem at hand. 92 high school students were surveyed in terms of the dependence of high school students on chat bots and their relation to their divergent thinking. Investigators constructed the scales relating to dependence on chat bots and divergent thinking to collect the data. The dependence of high school students on chat bots was studied in terms of usage, habituation, satisfaction, and credibility. The data were subjected to statistical analysis. The results and conclusions were drawn out from there.

**Statistical tools used**

The data were analyzed using descriptive and inferential statistics. The dependence on chat bots of the sample students was studied using percentages of their opinions relating to each statement of the scale. Pearson's Coefficient of Correlation and T-ratio values were calculated using the related statistical tools through SPSS.

**Analysis of data**

The present research deals with the analysis of the dependence of high school students on chat bots. It also analyses its relationship with their divergent thinking. The objective-wise analysis is presented below.

1. To study the dependence of high school students of the tri-city of Chandigarh on chat bots.

**Table 1: Dependence on Chat bots (CB) -Usage**

S.No.	Items	Component	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1.	I find all kinds of information from chat bots.	<b>Usage</b>	4 (4.3%)	29 (31.59%)	37(40.2%)	19(20.7%)	3(3.3%)
2.	I find it easy to use chat bots.		22 (23.9%)	45 (48.9%)	16 (17.4%)	9 (9.8%)	0
3.	I use chat bots to research for my projects/assignments.		14 (15.2%)	27 (29.3%)	23 (25%)	20 (21.7%)	14 (15.2%)
4.	I find difficulty in understanding or using a chat bots.		2 (2.2%)	2 (2.2%)	16 (17.4%)	54 (58.7%)	18 (19.6%)

Table 1 analyses the dependence of high school students on chat bots in terms of their usage of chat bots in daily assignments and research work. Around (32 + 4)% of the participants agree that they find all kinds of information from the chat bots whereas 23% disagree to this. Almost 40% are neutral or indecisive about it. It may also show low usage of chat bots by them. Almost 73% find it easy to you use chat bots only 9% find it difficult to use. Almost 45% use the chat bots for their projects and assignments but 37% say that they don't use them for this purpose, so disagreed with the statement. A huge percentage (58.7+19.6)% said that they do not find any difficulty in understanding the CB . The majority of the high school students of Chandigarh accept their usage of chat bots for educational pursuits.

**Table 2: Dependence on Chat bots-Habituation**

S.No.	Items	Component	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1.	I keep going to chat bots for smallest of information.	<b>Habituation</b>	1 (1.1%)	12 (13%)	18 (19.6%)	38 (41.3%)	23 (25%)
2.	I use chat bots for my daily homework		0	12 (13%)	18 (19.6%)	32 (34.8%)	30 (32.6%)
3.	I find it difficult to complete my assignments without using a chat bots.		1 (1.1%)	8 (8.7%)	10 (10.9%)	36 (39.1%)	37 (40.2%)

Table 2 highlights the formation of habits of students while using chat bots for their educational pursuits. Deeply understanding this variable, it has been found that around 61% of students disagree with the statement that they keep on going to chat bots for the smallest of information. Even 67.4% disagree with using chat bots for their daily homework. Even 65% of students feel that they do not need chat bots to complete their assignments. Thus the majority of students are not dependent on chat bots by forming the habit of using the chat bots. Only a very small percentage of students agreed to have formed a habit of using CB. Tri-city students disagree with the formation of the habit of using chat bots for their educational purposes.

**Table 3: Dependence on Chat bots- Satisfaction**

S.No.	Items	Component	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1.	Using chat bots increases my productivity.	<b>Satisfaction</b>	6 (6.5%)	31 (33.7%)	30 (32.6%)	13 (14.1%)	12 (13%)
2.	Chat bots help me to accomplish tasks quickly.		13 (14.1%)	47 (51.1%)	20 (21.7%)	8 (8.7%)	4 (4.3%)
3.	I am usually satisfied with the information provided by chat bots.		5 (5.4%)	41 (44.6%)	28 (30.4%)	10 (10.9%)	8 (8.7%)

Table 3 shows satisfaction by the high school students of the tri-city of Chandigarh while using Chat bots. Around 40% feel that chat bots increase their productivity whereas 27% disagree with the statement, and 32.6% have no opinion about it. Almost 65% (14 + 51) agree that they accomplish their task quickly using chat bots. Only 13% disagree with it whereas 20% are neutral towards it. Half of the participants (44.6 + 5.4) % are satisfied with the information provided by chat bots. 30.4% have no opinion about it. High school students in the tri-city of Chandigarh are satisfied with the use of Chat bots.

**Table 4: Dependence on Chat bots- Credibility**

S.No.	Items	Component	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1.	Chat bots always give me authentic and reliable information.	<b>Credibility</b>	3 (3.3%)	24(26.1%)	43 (46.7%)	14 (15.2%)	8 (8.7%)
2.	Chat bots understands my queries and statements well even if they are expressed informally.		6 (6.5%)	46 (50%)	26 (28.3%)	10 (10.9%)	4 (4.3%)
3.	I have to prompt the chat bot quite often to get an accurate answer.		6 (6.5%)	29 (31.5%)	33 (35.9%)	23 (25.1%)	1 (1.1%)
4.	I always have to regenerate the answers given by chat bot.		7 (7.6%)	22 (23.9%)	39 (42.4%)	22 (23.95)	2 (2.2%)
5.	I feel that there are many specific tasks or situations where chat bots excel and are more useful than traditional methods.		10 (10.9%)	44 (47.8%)	24 (26.1%)	10 (10.9%)	4 (4.3%)

Table 4 analyzes the credibility of chat bots for high school students. Only 29% find the information given by chat bots authentic and reliable but 24% disagree. A huge number 46.7% are uncertain about it. 52% (46 + 6%) are satisfied that chat bots understand their queries while only 15% disagree and 28.3% are unsure about it. Almost 59% agree that chat bots can do specialized tasks that cannot be handled with traditional methods, only 15% disagree, and 26% have no opinion about it. Thus high school students find the chat bots credible.

2. To study the correlation between dependence on chat bots and divergent thinking.

**Table 5: Coefficient of correlation between dependence on chat bots and divergent thinking**

S.No.	variable	N	M	SD	r <sub>A-B</sub>	Level of significance
A	Dependence on Chat bots	92	46.01	7.9	-.147	NA
B	Divergent Thinking	92	38.01	4.9		

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Table 5 shows the correlation between dependence on chat bots and divergent thinking. The coefficient of correlation value is -.147 which is not significant at .05 levels. Hence the hypothesis, “There is no significant correlation between dependence on chat bots and divergent thinking” may be accepted.

3. To study the correlation between components of dependence on chat bots and divergent thinking.

**Table 6: Coefficient of correlation between components of dependence on chat bots and divergent thinking**

S.No.	Variable	components	N	M	SD	r <sub>A1-B</sub>	r <sub>A2-B</sub>	r <sub>A3-B</sub>	r <sub>A4-B</sub>	Level of significance
A1	Dependence on Chat bots	Usage	92	14.12	2.49	-.14				NA
A2		Habituation	92	6.28	2.63		-.10			NA
A3		Satisfaction	92	9.96	2.57			-.09		NA
A4		Credibility	92	15.65	7.98				-.12	NA
B	Divergent Thinking	Divergent Thinking	92	38.01	4.9					

Table 6 shows the correlation between components of dependence on chat bots, that is, usage, habituation, satisfaction, credibility, and divergent thinking. The coefficient of correlation value is -.14, -.10, -.09 & -.12 respectively which are not significant at .05 levels. Hence the hypothesis, “There is no significant correlation between components of dependence on chat bots, that is, usage, habituation, satisfaction, credibility, and divergent thinking” may be accepted.

4. To study the significant difference in dependence on chat bots between girls and boys of high schools.

**Table 7: Mean difference in dependence of chat bots between girls and boys of high schools**

Variable	Gender	N	M	SD	SEm	Df	t-value	Level of significance
Dependence on Chat bots	Girls	75	45.84	7.88	.91	90	.651	NA
	Boys	17	46.76	8.64	2.09			

Table 7 shows the mean difference in dependence on chat bots between girls and boys of high school students in the tri-city of Chandigarh. The mean values for the dependence of chat bots between girls and boys are 45.84 and 46.76 respectively for 90 degrees of freedom. T- ratio value is .651 which is not significant at .05 levels. Hence the hypothesis, ‘there is no significant difference of dependence on chat bots between girls and boys of high schools of Chandigarh,’ may be accepted.

5. To study the significant difference in components of dependence on chat bots between girls and boys in high schools.

**Table 8: Mean difference in the components of dependence on chat bots between girls and boys in high schools**

Variable	Gender	N	M	SD	SEm	Df	t-value	Level of significance
Usage	Girls	75	14.03	2.57	.29	90	.67	NA
	Boys	17	14.53	2.15	.52			
Habituation	Girls	75	6.29	2.54	.29	90	.11	NA
	Boys	17	6.24	3.09	.75			
Satisfaction	Girls	75	9.88	2.49	.29	90	.46	NA
	Boys	17	10.29	2.91	.71			
Credibility	Girls	75	15.64	2.74	.32	90	.41	NA
	Boys	17	15.71	2.49	.61			

Table 8 shows the mean difference in components of dependence on chat bots between girls and boys of high school students in the tri-city of Chandigarh. The mean values for Components of dependence of chat bots between girls and boys are - usage -14.03 and 14.53, habituation- 6.29 and 6.24, satisfaction- 9.88 and 10.29, credibility- 15.64 and 15.71 respectively for 90 degrees of freedom. T-ratio values for usage, habituation, satisfaction and credibility are .67, .11, .46, and .41 respectively which are not significant at .05 levels. Hence the hypothesis, ‘there is no significant difference in components of dependence on chat bots between girls and boys of high schools of Chandigarh,’ may be accepted.

**6. There is no significant difference in divergent thinking between female and male high school students.**

**Table 9: Mean difference in the divergent thinking between girls and boys in high schools**

Variable	Gender	N	M	SD	SEm	df	t-value	Level of significance
Divergent Thinking	F	75	37.96	4.95	.57	90	.901	NA
	M	17	38.24	4.56	1.11			

Table 9 shows the mean difference in divergent thinking between girls and boys of high school students in the tri-city of Chandigarh. The mean values for divergent thinking between girls and boys are 37.96 and 38.24 respectively for 90 degrees of freedom. T-ratio value is .901 which is not significant at .05 levels. Hence the hypothesis, 'there is no significant difference of divergent thinking between girls and boys of high schools of Chandigarh,' may be accepted.

### III. Results and discussion

The results of the study showed that dependence on chat bots in total and its components separately have no relationship with divergent thinking for high school students of tri city of Chandigarh. Even high school girls and boys do not show any significant difference in dependence on chat bots in total and their components separately and even in their divergent thinking.

Though the majority has agreed that they have used it only a few have shown the habit of using the chat bots to complete their assignments or homework. They feel that the chat bots save their time and increase their productivity but at the same time, many students are not sure whether CB provides reliable and authentic information. There is a general lack of conviction about the accuracy of information provided by the CB. Similar results were found by Annus (2023).

Since the concept of CB is relatively new the students are yet to explore its complete usage potential and also the students may be depending on other resources for completing their projects, assignments, and homework.

The previous review of literature shows mixed studies like Annus (2023) found that over-dependence on CB can lead to loss of critical thinking among students, Vasconcelos and Santos (2023) found that CB can enhance reflective thinking and creativity among students, Barsoum and Awad (2022) found that cognitive style CB can develop critical thinking among students. A lot of diverse researches shall validate the relationship between CB dependency and divergent thinking shortly.

Also, the male and female students showed no difference in the dependence on CB in terms of usage, habituation, satisfaction and credibility. So gender seems to play no role in the use of CB. Male and female students also showed similar levels of divergent thinking which were further found to have no correlation with dependence on CB.

### IV. Conclusion

The technology has given a genie in the form of chat bots in the hands of students who can complete their work in no time. The ease of using chat bots is making them extremely popular among students. Whether dependence on CB is taking a toll on the ability of divergent thinking or enhancing it? Many more researches are required to find the answer.

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