



**Research/Technical Note**

# The Effect of Teacher Charisma on Student Attitude Towards Calculus Learning

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**Abstract:** Teachers with an understanding of what and how their teaching influence students' learning are better able to adapt their teaching in the class. The purpose of this study is to investigate the relationship between teacher charisma and student attitude towards calculus. There are 1,150 Taiwanese undergraduates participated the research and two instruments, Attitude Toward Calculus Inventory (ATCI) and Inventory of Teaching Charisma in the College Classroom (ITCCC), were used to assess the participants' attitudes toward calculus and the perception about their teacher charisma. After collection of data, analyses including descriptive statistics, t test, correlation analysis, and multiple linear regression analysis were performed in SPSS. The study concludes that there are differences between the attitude levels of students by gender; male students report more positive attitudes than females on calculus. Moreover, students' perceptions of the teacher's charisma were found to contribute significantly to the predictor equation for students' attitude towards calculus.

**Keywords:** Student Attitudes, Teacher Charisma, College Students, Calculus

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## 1. Introduction

Mathematics is not only important for individual with career interests in fields, but also is a subject that provides thinking skills invaluable to everyday life [1]. Due to the significance of such subject, it is necessary to focus student learning on mathematics or mathematics related courses. Student attitude which is one of variables related to student's mathematics learning have recently received increasing attention. Students' attitudes toward mathematics are reported to affect their ability to learn it, and even influence their mathematical achievement [2] [3] [4] [5] [6]. To find factors related to positive attitudes will contribute to the improvement of students' academic learning. On the other hand, the teacher is considered to be a key factor in promoting active learning [7], thus, this study explores how far a teacher's charisma contributes to student attitudes toward calculus and how the student attitudes toward calculus is in a sample of Taiwanese college students. Additionally, we also examine gender difference in their attitudes.

### 1.1. Student Attitudes Toward Mathematics

Attitudes toward mathematics are initially considered as one's belief concerning enjoying or not enjoying mathematics, being or not being inclined to mathematics activities, considering oneself as successful or not successful in mathematics, and believing mathematics is useful or useless [8]. Following this viewpoint, researchers operationally defined attitudes toward mathematics as one's feelings and emotions toward mathematics that includes self-confidence, value, enjoyment, and motivation components [9] [10] [11] [12]. Self-confidence refers to the extent to which one believes he/she has enough ability to succeed in mathematics. Value refers to the extent to which one's beliefs about the usefulness and worth of mathematics in his/her life. Enjoyment refers to what degree one enjoys working mathematics problems and attending mathematics classes. Motivation refers to what degree one's interest in mathematics and desire to pursue

studies in mathematics. The present study adopts it as the definition of attitudes toward calculus. That is, a student who thinks he/she is competent in calculus, believes calculus is useful in his/her life, enjoys in calculus activities, and desires to pursue studies in calculus, is considered to have positive attitudes toward calculus.

A lot of research supports the positive role that students' attitudes toward mathematics plays in their academic achievement and careers in the mathematical sciences [3] [6] [13]. Buckley argued that if a student enjoys in class they will be motivated to invest more effort in that class and perhaps future classes and they will learn more effectively [1]. According to Ashcraft and Kirk, a student with favorable attitudes tends to enjoy mathematics and consequently his/her mathematical competence increased; conversely, a student with poor attitudes always has avoidance behavior and consequently his/her mathematical competence decreased [14]. Additionally, students who have more positive attitudes about their studies were found to not only become better learners about their studies but also have less mathematics anxiety [15]. Therefore, positive attitudes toward mathematics are desirable because that they may influence a student's willingness to learn and also the benefits a student can derive from mathematics instruction [16].

Positive attitudes benefit student learning, however negative attitudes have the opposite effect and can lead to students avoiding behaviour. Ruffins indicated that students who fear mathematics have a tendency to exhibit avoidance behaviors such as not attending class, not participating while in class, and even acting out while in class, which decreases their mathematics competence and achievement [17]. Similarly, Ryan and Ryan stated that college-level students who have fear of mathematics did not participate or complete assignments, and avoided the teacher and the subject [18]. Even worse, some students with negative attitudes have suffered from high levels of mathematics anxiety and consequently avoided mathematics as much as possible and performed worse in mathematics [1] [19]. It would be beneficial to prevent students from negative attitudes.

Further, student attitudes might be gender related. Studies of gender differences in attitudes toward mathematics generally suggest that male students have more favorable mathematics attitudes [10] [20] [21]. For example, Lin and Huang reported that male students indicate higher enjoyment of mathematics, consider themselves more successful at mathematics, and believe more that mathematics was useful than female students [10]. Work of Asante, with high school students, found that boys have higher mean scores in attitude scales (including Self confidence, Enjoyment, Value, and Motivation subscales) than girls [20]. Frenzel, Pekrun and Goetz, with a sample of 5th grade students, found that girls reported significantly more anxiety, hopelessness and shame, and less enjoyment and pride than boys [22]. In contrast to those studies, there are some other studies which suggest that females are more likely to hold positive attitudes toward mathematics or perceived mathematics as more important than males [23] [24]. However, there are many studies suggest

that there is no significant difference between attitude towards mathematics among different gender students [3] [4] [5] [25]. In Taiwan, the majority of students in math-related field (including science, engineer, computer, etc.) are males and one strong stereotype is that females are likely do worse than males in mathematics courses [26]. Therefore, gender differences in attitudes toward the subject matter among Taiwanese students need to be examined.

### **1.2. Teacher's Charisma**

When students are attracted by a charismatic teacher, they enjoy learning and listening to the class. Previous research have listed a lot of characteristics about teacher's teaching charisma, for example knowledge, teaching method, virtue, character, tolerant, openness and candor, patient and suspended reprimand, compassion and unconditional attention, focusing on student learning, goal establishment, careful preparation, enthusiasm, humour, performance and etc [27] [28] [29] [30]. It can be seen that a consensus of opinion about definite definition of a teacher's charisma has not yet to be reached among researchers.

Recently Huang and Lin reviewed literatures on good teaching and concluded that a charismatic teacher should have some key characteristics [31]. First, he/she should be knowledgeable [32] [33]. The teacher should have knowledge and can use this knowledge in teaching practice. Second, because a teacher is expected to be good role models for students, he/she should have positive character traits (e.g., friendliness, approachability, patience and enthusiasm) [32] [34]. Third, he/she should have a good sense of humour since students prefer attending to an interesting class [35] [36]. Finally, he/she should adopt appropriate teaching method in order to appeal students to learn [34] [37]. In short, Huang and Lin proposed that a teacher possesses of the four characteristics, including professional knowledge, positive character traits, sweet humour and good teaching techniques, can be regarded as a charismatic teacher [31]. Lee et al. had the similar viewpoint, recognizing a teacher's charisma by the four dimensions of knowledge, character, humour, and teaching methods [38]. Thus, this study adopts those four factors in Huang and Lin and Lee et al. to assess a teacher's charisma [31] [38].

### **1.3. Teacher's Teaching and Student Learning**

Recently several studies have focused on identifying the key factors that make the student attitudes affirmative in learning [5] [39] [40] [41]. As one would expect, there are many variables that contribute to student attitudes. When reviewing literatures on students' attitudes toward mathematics, Mohamed and Waheed summarized three groups of the important factors that influence student attitudes [5]. Among these groups, one is associated with the teacher or teacher's teaching which includes teaching materials teacher used, teachers' classroom management, teachers' content knowledge and personality, teaching methods and etc. It is believed that as a teacher establishes a supportive social climate in the classroom, students are more likely to be

receptive to learning [40] [42].

In particular, a charismatic teacher was considered to appeal to students which are then attracted to the classes. Lin and Huang examined the effects of a teacher's behaviour on student engagement. Results provided the evidence that increasing the teacher's charisma can increase student engagement [43]. Lee et al. investigated the influence of the teachers' charisma on students' learning interest. Results supported that a teachers' charisma has a positive influence on inducing the students' learning interest [38]. Similarly, Lin and Huang also investigated the relationship between a teacher's charisma and a student's interest in learning. They pointed that a teacher's charisma significantly contributed to predict the students' learning interest [42]. It is supported the importance of the teacher's charisma in promoting active learning and it is reasonable to argue that the teacher can stimulate a student's attitudes in the subject matter in some way and impacts the student's learning.

#### 1.4. The Present Study

Previous research has illustrated the importance of teacher charisma on student learning, especially in learning interest and engagement. Although there has been increasing attention on teaching quality and effectiveness, how a teacher's charisma influences college students' attitudes has not been well researched. Understanding the role that the charisma of the teacher plays in effecting student attitudes will help in better understanding how this impacts their learning. Therefore, the purpose of this research is to identify contributions of the teacher's charisma to the level of college students' attitudes created by the teacher. Additionally, the differences in attitudes toward calculus between different genders are also examined.

## 2. Methods

### 2.1. Participants

Participants were 1,150 undergraduates (37.8% male and 62.2% female) who attended calculus classes at six universities in the Central region of Taiwan. They majored in accounting (36.1%), economic (24.3%), international business (17.2%), applied statistics (11.5%), and public finance (10.9%), and 99% of them were freshmen. The students from five available classes of each university were invited to join the study. After being informed of the research purpose, 94% of the invited students voluntarily filled out a content letter and questionnaire during a class time.

### 2.2. Measures

Participants were asked to provide some demographic information including age, gender, and major in college. In addition, the questionnaire consists of two scales stated as follows.

#### 2.2.1. Inventory of Teaching Charisma in the College Classroom (ITCCC)

The 23-item ITCCC is used to measure the students'

perceptive degree of teaching charisma from his/her teacher (for the calculus course) [31]. It consists of four subscale including Knowledge (7 items, example item: My teacher is an expert in this field), Character traits (6 items, example item: My teacher is very responsible), Teaching techniques (4 items, example item: My teacher uses some creative teaching techniques), and Humour (6 items, example item: We are never bored in my teacher's class). Students rate items on the extent to which they agree with each statement using a 5-point Likert-type scale, ranging from 1 (never true) to 5 (always true). The higher the score, the higher the degree of teaching charisma. In the current study, the Cronbach's alpha coefficient for each subscale was .90, .91, .94 and .91 respectively.

#### 2.2.2. Attitude Toward Calculus Inventory (ATCI)

The 20-item ATCI is used to measure attitudes toward calculus among college students [9]. The scale taps four facets of students' attitudes including Self-confidence (6 items, example item: Calculus is not difficult for me), Value (5 items, example item: Calculus is a very useful and necessary subject), Enjoyment (6 items, example item: Calculus makes me feel spirited), and Motivation (3 items, example item: Calculus is interesting for me). The items are constructed using a 5-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores indicate more positive attitudes toward calculus. In the current study, the Cronbach's alpha coefficient for each subscale was .86, .85, .82 and .78 respectively.

### 2.3. Procedure and Data Analysis

The instruments for this study were administered at the end of School year 2015. Participants were recruited from the calculus classes at six universities in the Central region of Taiwan. The purpose of the study was explained by assistants to the teachers and students and obtained consent to participate in the study from students. Participants were assured of confidentiality and informed that the data collected in the study would be only for research purpose and would not influence their grade in the course. It took about 20 minutes for the participants to complete questionnaires.

Data were analyzed using SPSS 20.0. The descriptive statistics, t test and correlation analysis were performed. In multiple linear regression analysis, the relationship between the dependent variable, student's attitude toward calculus and the following four predictor variables were tested: character traits, knowledge, humour and teaching techniques.

## 3. Results

### 3.1. Descriptive Statistics and Correlations of Variables

The means, standard deviations and correlations among the variables are presented in Table 1. Overall, the mean scores of ITCCC and ATCI subscales are around 3.00. The relationships between attitudes toward calculus and teacher's charisma are low-to-medium and positive. Students perceived more teacher

charisma tend to have more positive attitudes toward calculus than students who perceived less teacher's charisma.

**Table 1.** Means, standard deviations, and correlations of ITCCC and ATCI.

	M	SD	Self-confidence	Value	Enjoyment	Motivation	Overall ATCI
Knowledge	3.50	.79	.26**	.33**	.25**	.30**	.35**
Humour	3.04	.89	.26**	.40**	.24**	.32**	.37**
Character traits	3.74	.72	.15**	.26**	.20**	.21**	.25**
Teaching techniques	2.79	.90	.26**	.38**	.25**	.34**	.37**
Overall ITCCC	3.32	.69	.28**	.40**	.28**	.34**	.40**
M			3.16	3.00	3.18	2.96	3.10
SD			.78	.83	.74	.79	.63

\*\* p<.01

### 3.2. Gender Differences in Student's Attitudes Toward Calculus

As Table 2 below shows, both male and female students report to have mean scores on attitudes toward calculus around 3.00. It also reveals that there are statistically significant differences between the attitude levels of students

by gender (except on the Enjoyment subscale). Overall, male students report more positive attitudes than females on calculus.

**Table 2.** Test for gender differences of student's attitudes toward calculus.

Subscale/Scale	Male (n=435)		Female (n=715)		Mean difference	t - value
	Mean	SD	Mean	SD		
Self-confidence	3.34	.78	3.05	.75	.29	6.394***
Value	3.16	.84	2.91	.81	.25	4.964***
Enjoyment	3.20	.76	3.16	.73	.04	.866
Motivation	3.05	.81	2.91	.77	.14	2.783**
Overall ATCI	3.21	.64	3.03	.61	.18	4.846***

\*\*p<.01, \*\*\* p<.001

### 3.3. Regression Analysis for the Effect of Teacher's Charisma on Student's Attitude Towards Calculus

The regression analysis summary, by the stepwise regression method, is presented in Table 3. The results show that three factors of the ITCCC, including Humour, Knowledge, and Teaching techniques, are significantly related to student attitude towards calculus. All Beta values are positive, indicating that Humour, Knowledge, and Teaching techniques have positive influences on student attitude. Of these, teaching techniques indicate to have the strongest influence on student attitude. The higher the level of these three variables for students perceived from teacher, the more positive attitude they have. These factors accounts for 17% of the variance, indicating that these factors can be used to effectively predict 17% of the student attitude towards

calculus. The following equation better allows us to see the relative contributions of the independent variables.

$$\text{Attitude} = (0.128 \times \text{Humour}) + (0.171 \times \text{Knowledge}) + (0.175 \times \text{Teaching techniques}) \quad (1)$$

Because, from earlier results, there are differences in student attitudes between male and female groups, we wonder whether the differences also exist in the prediction from teacher's charisma. The regression analysis was also applied individually to male and female groups and some differences were noted. In male group, the results (presented in Table 3) show that Humour and Knowledge are significantly related to student attitude, yet Teaching techniques and Knowledge are the predictors of student attitude in the female group.

**Table 3.** Summary of regression analysis for factors predicting student's attitude.

Variable		Unstandardized Coefficients		Standardized Coefficients	t value	Sig.
		B	Std. Error	Beta		
Total <sup>a</sup>	Constant	2.005	.078		25.750	.000
	Humour	.090	.033	.128	2.741	.006
	Knowledge	.136	.028	.171	4.923	.000
	Teaching techniques	.122	.031	.175	3.946	.000
Males <sup>b</sup>	Constant	1.835	.142		12.905	.000
	Humour	.198	.036	.286	5.532	.000
	Knowledge	.209	.047	.232	4.473	.000
Females <sup>c</sup>	Constant	2.109	.092		22.859	.000
	Teaching techniques	.181	.030	.258	6.079	.000
	Knowledge	.124	.031	.168	3.965	.000

Note. <sup>a</sup>.  $R^2 = .173$ ; <sup>b</sup>.  $R^2 = .211$ ; <sup>c</sup>.  $R^2 = .144$

## 4. Discussion

The results of this study support the previous findings that the teacher's teaching has positive influence on college students and stimulates them to learning. Lin and Huang found that factors of teacher's charisma are the important variables in enhancing college student engagement [43]. Also, Lee et al. and Lin and Huang both suggested that teacher's charisma has a certain impact on students' learning interest [38] [42]. In the present study, there is evidence to suggest that teacher's charisma is related to student attitudes toward calculus. This suggests that college students who perceive teacher's charisma are more likely to have positive attitudes toward calculus. That is, a student perceiving his/her teacher who has good character traits, professional knowledge, sweet humour, and extraordinary teaching techniques is more likely to have confidence in ability, belief of worth, enjoyment or desire in learning calculus. This may be attributable to a charismatic teacher who has great appeal for most students.

The study also finds that some kinds of teacher's charisma, including teaching techniques, teacher's character traits and knowledge, can significantly predict student attitude towards calculus. However, these factors only explain 17% of the variance in student attitude. This means that teacher's charisma has but limited contribution to student attitude towards calculus. Similar research taken in the same course (calculus), Lin and Huang found that teacher's charisma significantly contributed to predict students' learning interest and it explains 39% of the variance in the interest [42]. It seems that, with regard to calculus, teacher's charisma has stronger impact on students' learning interest than on their learning attitude. It indicates that teacher with good teaching can arouse student interest in calculus class but only reform student belief slightly in the subject. Anyway, both of learning interest and attitude are suggested to be related to teacher's charisma, revealing the teacher plays an important role in the advancement of college student learning. These results support the fact that the characteristics of an instructor have a great impact on students' attitude [5] [40].

As to the differences between genders in attitudes, the results from the study show significant gender differences in learning calculus. It is consistent with previous research that male students report more positive attitudes than females on mathematics [10] [20] [21] and corresponds to the common social perception of male superiority in mathematics in Taiwan [26]. Perhaps due to this societal stereotype cause females to feel that they do not belong in mathematics classes and may influence their learning [21]. However, our results have something differ from those of Lin and Huang [10]. Lin and Huang found that females show lower enjoyment, self-confidence, and perceived value of mathematics than males and there is no gender difference regarding the factor—Motivation [10], whereas the present study find that the only similarity between genders in attitudes is the factor—Enjoyment. We consider that the different findings are perhaps due to the differences between targets. The research

of Lin and Huang had mainly recruited college students from colleges of Engineering and Science as participants [10], whereas we conduct the study on the college of Business. There might be some differences in responses to survey items between samples from different departments.

Interestingly, in addition to the different mean scores in attitudes, the difference also appears in the separate predictor equation of student attitude for male and female groups. In male group, the results show that Humour and Knowledge can significantly predict student attitude, yet Teaching techniques and Knowledge are the predictors of student attitude in the female group. It indicates that, in addition to the common factor—Knowledge, males depend highly on Humour and females depend highly on Teaching techniques in the calculus class. Gender differences emerge once again. The results suggest that teachers of calculus need to become aware of gender influences related to calculus learning. Also, future studies into individual differences in learning attitudes should take into account the effects of gender.

As experienced teachers in college, authors found it is not strange that some of students have difficulty or barrier while learning mathematics related courses such as calculus. The findings from this study could provide teachers or instructors the recommendations for instruction to assist their students in overcoming obstacles. Teachers (or instructors) can help students to improve learning on calculus in several ways. First, teachers should display appropriate behaviours, especially in the aspect of morality since teachers' behaviours, attitudes, appearance, and character may influence the interaction between teacher and students in the classroom [44]. Second, it would be beneficial to incorporate humor in the classroom since students are often attracted to those who have a sense of humor [36]. Third, teachers should continue enriching himself/herself in knowledge. Students admire those teachers who not only have knowledge but also can use this knowledge flexibly in the classroom. Finally and most important of all, teaching techniques are found to have the strongest influence on student attitude, suggesting teachers should adopt the most suitable teaching method for their students and had better teach students in accordance with their aptitude. As student's attitudes toward calculus getting positive student's academic achievement in the subject matter might be improved.

The present study suggests interesting results, however, it still has some limitations cannot be ignored. First, the study investigated teacher's charisma by focusing on some specific characteristics of teacher, maybe there are other characteristics need to be included or considered. Second, the sample for the study was mainly drawn from college of Business that the findings may not be generalized to participants with different backgrounds such as those who come from college of Engineering or Science. Third, in this study, female students (62.2%) were overrepresented in the sample; therefore, the results may not be widely applied to other student populations. Future studies should take the issue into account. Finally, the relationships of variables found in the study only directed at the calculus course. Additional research that focuses on

student attitudes toward general curricula is needed.

## 5. Conclusion

In conclusion, the findings suggest positive correlations between student attitude and teacher charisma and also provide some evidence about the gender differences in calculus attitudes. Based on the results of this study, it may be suggested that students' attitudes toward calculus can be improved by teacher's charisma includes factors of knowledge, character, humour, and teaching methods. For providing more information for teachers or instructors to get further understanding about students' learning, future research should extend our study to students in different kinds of curricula and to students differing in departments or cultures.

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