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Research Article

Teaching styles of biology educators: The influence of demographics and self-efficacy on pedagogical approaches

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ABSTRACT

Teachers play an important role in the holistic development of learners. Consequently, they are lifelong learners who need to professionally develop themselves to ensure excellent classroom learning experiences. Teachers' perceived teaching styles, demographics, and self-efficacy may contribute to the overall teaching performance. This article explored the perceived teaching styles of biology teachers and their correlation with teacher demographics and self-efficacy beliefs as contributing factors to teaching approaches and preferred teaching styles among learners. Adopting a descriptive research design, the researcher gathered data from 94 respondents using a profile sheet, teaching styles inventory, and teachers' sense of efficacy scale. Employing an inferential statistical tool, through a Chi-square test, the findings indicate that there is a significant correlation between teaching styles and the demographics and level of self-efficacy of teachers. The sex, years of teaching, professional development trainings, institutions, and level of self-efficacy contribute to learner- or teacher-centered teaching approaches. Meanwhile, the learners preferred learner-centered teaching styles. Moving forward, interventions on identifying biology teachers' pedagogical approaches as a factor for the decision-making of pedagogical enhancements, focusing on the gaps in the teaching practices, and aligning their teaching style to their subject matter and the demands of the learners.

Keywords: demographics, perceived teaching style, preferred teaching style, self-efficacy beliefs

INTRODUCTION

Teachers carry out the most critical responsibility in the development of learners. They develop the curriculum, implement varied teaching strategies based on students' needs, and assess the retention of concepts. They directly affect what and how students learn, how much they learn, and the ways they interact with one another. The relationship and interaction between teachers and students contribute to the student's progress and attitude toward learning (Reyes-Torres & García-Perera, 2022).

In the latest program for international student assessment test on creative thinking, the Philippines ranks bottom and is placed bottom four compared to other countries. The country ranked 76th in mathematics, 77th in reading, and 79th in science among 81 countries, with scores far below the baseline proficiency (Chi, 2024; RITQ, 2024). These results call for educational reforms that have been made as a driving force to academic success among Filipino learners. However, the quality of education, whether high or low, is not only caused by the educational processes. Learning gaps and low scientific literacy skills can also be influenced by the low performance of teachers as educators (Tupas & Noderama, 2020).

Teachers plan their strategies that are well-suited to the subject matter and the needs of the learners for better knowledge acquisition. However, teachers encounter challenges, especially when deciding on the most appropriate teaching style. Several studies have identified teachers' teaching style and their relationships with other variables (Arifani, 2021). Provided with the vast existing information on the teaching style and its relationship with other variables conducted in other countries, there is still a need to study teachers' teaching styles in the Philippines due to its concerns regarding the grassroots system. At the grassroots of the education system, teachers are expected to participate in the implementation of various government programs; however, the majority of teachers believe their opinions are not frequently considered in policy discussions and decision-making processes (Albert et al., 2019; Will, 2021). Decision-making should involve the perspectives of those who will be responsible for carrying out the decision directly and who have relevant experience with the decision (Chiaro, 2021).

Studies were conducted involving teachers' teaching styles and their relationship to other variables. Researchers pursued their interest in investigating the teaching styles of biology teachers. Different standardized assessments were administered to the teachers to identify their perceived teaching styles. There are five teaching styles described by Grasha-Reichmann, including the learner-centered styles such as facilitator, delegator, and personal model. The teacher-centered teaching styles are formal authority and expert (Gill, 2020a, 2020b).

Dash et al. (2020) investigated the preferred teaching styles of medical faculty using the Grasha-Riechmann teaching style inventory and found that there is a significant relationship between formal authority teaching style and male teachers. Female teachers were more prone to interacting with their students on how and what to teach in their classes, whereas male professors demonstrated greater autonomy by setting the learning agenda for students. In addition, the study conducted by Sabado et al. (2019), the demography of teachers was investigated to determine if it is a contributing factor to teachers' teaching style. Demographic details such as sex, family income, teaching experience, and seminars or trainings attended were found to influence teachers' personal model, facilitator, and delegator teaching styles. Male teachers were discovered to use a more delegator teaching approach than females. It was also discovered that teachers with lower family incomes and fewer seminars or training courses attended were more likely to be personal models and delegators. Furthermore, sex and training or seminars have an impact on teachers' teaching performance.

Another demographic data under study is the training attended by the teachers and the type of educational institution they are affiliated with. Teachers with more training were found by students to be more confident, have a better teaching style, and could overcome learning difficulties. Previous research found that collaborative peer and reflective teaching, as well as mentoring activities for teachers' professional development, could boost teachers' confidence, teaching style, and ability to overcome barriers (Arifani, 2021). In addition to the demographic profile mentioned by the previous studies, the type of school was found to be a predictor of the teaching style of teachers. Public and private schools both adopt teaching-centered teaching styles based on an analysis conducted by Yıldız and Karakullukçu (2019).

Researchers were also interested in determining the relationship between teachers' self-efficacy beliefs and their perceived teaching styles, as evidenced by the following publications. In the investigation of Kaya et al. (2020), teachers are found to be more confident in using a teacher-centered teaching style to teach science rather than learner-centered inquiry. Teachers' professional background, including mastery of the subject, pedagogical expertise, and professional experience, made an impact on their self-efficacy to teach science in an inquiry-based approach. This is contrary to the study of Buzzai et al. (2022) that teachers' viewpoints toward multicultural education limited the relationship between the efficacy of teachers toward more learner-centered practices and more motivating teaching styles. Hence, teachers' efficacy for inclusive practices was a direct positive predictor of motivating teaching styles.

The correlation of teaching styles and self-efficacy to other factors was supported by several associated theories, pieces of literature, and studies. Unfortunately, there is a paucity of literature on the association among teacher demography, perceived teaching styles, and teacher level of self-efficacy beliefs, particularly among public and private high school biology teachers in the country, which cleared the way for this research.

At present, there is a gap in the evaluation systems in the Philippines, identifying the teachers' professional development needs and the necessary support for professional learning opportunities. Biology teachers should be provided with professional training focused on addressing gaps in skills and competencies in biology education, rather than providing them with generalized science education training for teachers. Furthermore, rationalizing and systematizing all teacher training for a more personalized and responsive professional development for biology teachers remains a challenge despite the provision of international and non-government organizations providing training to the department of education in the Philippines (Albert et al., 2019).

Thus, the researcher conducted a study on the teaching style and its relationship to teacher demography and self-efficacy beliefs among biology teachers in Cebu City. The researcher intends to help the education sector in identifying the contributing factors of teachers' perceived teaching styles to analyze what may be improved in promoting quality instruction in biology education, to address the inadequacy at the grassroots of education by the education sector.

Research Objectives

1. To determine the demographics of the respondents in terms of sex, number of years teaching, number of training attended related to teaching, and type of school taught
2. To investigate the perceived teaching styles of the respondents teaching biology
3. To investigate the levels of self-efficacy beliefs of the respondents teaching biology
4. To examine the relationship between the perceived teaching styles of the respondents to their demographics and self-efficacy beliefs.
5. To investigate the preferred teaching styles of the learners learning biology

MATERIALS AND METHODS

Research Design

This study used a descriptive research design employing correlational analysis to identify the relationship between the perceived teaching styles of the teachers and their demographic information, such as sex, years of teaching experience, number of training attended, and type of school. In addition, correlational analysis was utilized to identify the correlation between the teaching styles and levels of self-efficacy beliefs. Hence, the relationship among all these variables was analyzed.

Research Environment

The study was conducted in six randomly selected schools situated in Cebu City. All of the schools situated in the city were listed and classified as public and private high schools. From each of the classifications, three schools were included using the fishbowl method for a total of six research locales of the study. The schools offered the Department of Education's approved science curriculum at the Junior High and Senior High school levels. Public high schools have at least fifteen biology teachers each, while private schools have at least ten biology teachers each. The survey was conducted during the school year 2022-2023. Due to the existing COVID-19 cases in the city, all the schools either implemented modular or remote blended learning under distance learning.

Research Respondents

The respondents of this research were high school biology teachers in Cebu City from both public and private high schools who were randomly sampled using the fishbowl method. The teachers must have completed at least a bachelor's degree with a major in science or biology and taught biology for at least one school year to be respondents. There were a total of thirty-nine teachers from private schools and fifty-five teachers from public schools.

The researcher utilized simple random sampling, applying the fishbowl method to choose the students from the class of the teacher respondents to evaluate the teaching style of their teacher and determine the preferred teaching style for biology education.

Data Collection Instruments and Validation

The main research instruments of the study included assessing teachers' teaching styles using the teaching styles inventory (TSI) developed by Grasha (1994). This scale determines the teaching styles of the teachers. This instrument revealed the self-reported style preferences corresponding to the actual observable teaching style behaviors of teachers in various instructional situations (Ford et al., 2016). The scale is made up of 40 items that are used to rate the teachers' teaching styles on a scale of 1 to 5, with particular markers "strongly disagree" and "strongly agree" assigned, respectively. Each item in the survey is attributed to a specific teaching style, and the highest score was used to establish their teaching style, whether they fall under **expert**, **formal authority**, **personal model**, **facilitator**, or **delegator**.

Another instrument used was the Ohio State teacher efficacy scale, better known as the teachers' sense of efficacy scale (TSES), developed by Tschannen-Moran and Woolfolk Hoy (2001). This scale determines teachers' judgment of their capability of causing the desired outcome despite difficulties. It consists of 24 questions categorized into three, namely: efficacy in student engagement, efficacy in instructional strategies, and efficacy in classroom management, with ratings ranging from 1 to 9, with identifiers "nothing" to "a great deal" assigned, respectively. Their level of self-efficacy was determined by their average scores, either **very low**, **low**, **moderate**, **high**, or **very high**.

The research instrument's validity and reliability were tested with the standardized tool for both teaching styles and self-efficacy. After the validation process, pilot testing was conducted for reliability testing by a statistician to ensure the reliability of the assessments, even if they are standardized assessments. Cronbach's (1951) alpha was used to measure the internal consistency of the questionnaire. The result yielded a Cronbach's (1951) alpha value of .791 to .842 for the teaching style inventory with an overall value of $\alpha = .969$ and a value of $\alpha=.965$ for the TSES. Thus, the reliability of the questionnaires is generally acceptable.

Data Collection Procedures

Prior to the conduct of the study, a letter was addressed to the school division superintendent of the department of education-Cebu City division requesting permission to conduct the research. Following the approval, letters were sent to the principals of public schools to inform them of the approved study, and another letter was sent to private high school principals for approval.

After the approval of the school principals, an email was sent to the teachers, including the approved letter from the principal and the consent letter for research participation. The email included the link to access the office form to obtain the demographics of the teachers using the teachers' profile sheet. The perceived teaching styles of the teachers were identified using the TSI by Grasha (1994). The respondents completed a 40-item standardized evaluation questionnaire to determine which of the five teaching styles they exhibited. The level of self-efficacy beliefs of the teachers was obtained using the TSES by Tschannen-Moran and Woolfolk Hoy (2001). The respondents completed the 24-item survey for the evaluation of their own efficacy beliefs in biology teaching.

The feedback of the students was obtained using the Students' Feedback included in the survey form. The survey was administered online, and they were asked to read the descriptions of each teaching style to identify which teaching style their biology teacher demonstrated and what they think is the best teaching style for biology teachers. This study took effect from August to September, the first quarter of the school year 2022-2023.

Analysis of Data

To determine the teachers' teaching style and self-efficacy, a sample mean was computed. In this study, the teachers' self-evaluation was computed and divided by the total items in a questionnaire. The Chi-square of Independence was used to determine if there is a significant relationship between two nominal variables. The frequency of each category for one nominal variable is compared across the categories of the second nominal variable. In this study, the perceived teaching styles of the respondents were analyzed with their demographic information and level of self-efficacy using the Chi-square of independence. All tests were set at a 5% level of significance.

RESULTS & DISCUSSION

Demographics of Teacher Respondents

A researcher-developed teacher's profile sheet was utilized to collect the respondents' demographic information. **Table 1**

Table 1. Teacher respondents' profile teaching the biology subject

Variables	f	%
Sex		
Male	15	16.0
Female	79	84.0
No. of years teaching		
1-5	41	43.6
6-10	30	31.9
11-15	14	14.9
16-20	5	5.3
21 and up	4	4.3
No. of training attended related to teaching		
1-5	4	4.3
6-10	32	34
11-15	21	22.3
16-20	14	14.9
21-25	15	16
26-30	5	5.3
31 and up	3	3.2
Type of school		
Private	39	41.5
Public	55	58.5
	n = 94	**100**

displays the gender, years of teaching experience, number of training sessions participated in, and the type of school at which the respondents have taught.

Table 1 reveals the total number of respondents (n = 94) and each variable's demographic subclassification. More female teachers (84%) than male teachers (16%) responded from selected schools in this study. Most of these teachers were new to the profession, with 43.6% having been in the classroom for 1 to 5 years and 31.9% having been in the classroom for 6 to 10 years.

Among the participants, merely three teachers had the highest number of training sessions, whereas 32 (34%) had between six and ten teacher training sessions. Fifty-five (58.5%) of the participants are presently associated with public high schools, while the rest are linked to private educational establishments.

In summary, most of the teacher respondents were females, new to the teaching profession, had little training related to teaching, and mostly belonged to public schools.

Perceived Teaching Styles of Biology Teachers

The respondents were given Grasha's (1994) teaching style inventory to help them identify their perceived teaching styles. The mean score of each teacher-respondent was determined to compare it to the result of each teaching style. As a result,

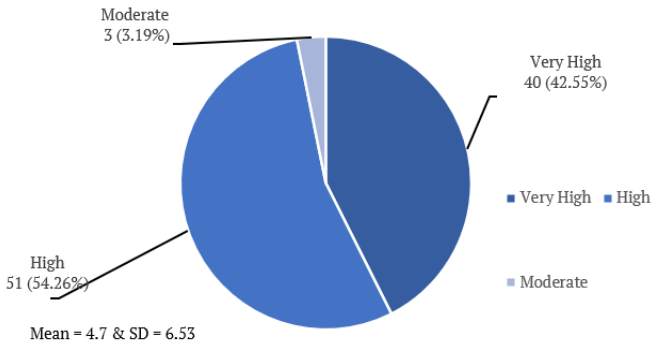

Figure 1. Teacher's level of self-efficacy belief (Source: Authors' own elaboration)

Table 2 shows the frequency of teachers under each teaching style from private and public high schools.

As seen in **Table 2**, the result shows that most of the private and public school teachers' teaching styles were identified as **facilitators** at 19 (48.72%) and 25 (45.45%), respectively. As a whole, 44 (46.81%) respondents were categorized as **facilitators**. This is followed by the **personal model** (29.79%), **delegator** (12.76%), **formal authority** (6.38%), and **expert** (4.26%).

The result affirmed that the main teaching style of biology teachers was the **facilitator** style and that biology teachers should use learner-centered teaching strategies since learner-centered teaching styles reported higher levels of interest than those who were taught using teacher-centered teaching styles.

Level of Self-Efficacy Beliefs of Biology Teachers

The self-efficacy beliefs among all biology teachers were determined using the TSES, authored by Tschannen-Moran and Woolfolk Hoy (2001). The outcome of the survey is shown in **Figure 1**.

According to the graph, most of the teacher-respondents believed themselves to have **high** level of self-efficacy, which is equivalent to 51 (54.26%), 40 (42.55%) exhibited a **very high** level, and only three (3.1%) had a **moderate** level of efficacy. None of the respondents showed **low** or **very low** levels of efficacy.

The result reveals that all teacher respondents exhibited confidence in their ability to teach biology effectively. The **moderate** to **high** levels of self-efficacy among the teacher-respondents show that biology teachers in the selected schools were efficient in causing student engagement, implementing instructional strategies, and classroom management.

The finding opposes the belief that homogeneity in demographic information had been shown to increase instructors' perception of efficacy. In contrast, this study

Table 2. Perceived teaching styles of teacher respondents from private and public high schools

Teaching style	Private school teachers		Public school teachers		Total	
	f	%	f	%	f	%
Expert	1	2.56	3	5.45	4	4.26
Formal authority	2	5.13	4	7.27	6	6.38
Personal model	7	17.95	21	38.18	28	29.79
Facilitator	19	48.72	25	45.45	44	46.81
Delegator	10	25.64	2	3.65	12	12.76
Total	**39**	**100**	**55**	**100**	**94**	**100**

Table 3. Chi-square analysis on the teaching styles and sex of the respondents

Sex	Facilitator/delegator	Expert/formal authority/personal model	n	Test statistics	
				Computed x^2	p-value
Female	51	28	79	5.10	.024*
Male	5	10	15		
Total	**56**	**38**	**94**		

Note. *Significant at α = .05

Table 4. Chi-square analysis on the teaching styles and years teaching of the respondents

No. of years teaching	Facilitator/delegator	Expert/formal authority/personal model	n	Test statistics	
				Computed x^2	p-value
1 to 5	28	13	41	10.76	.005*
6 to 10	21	9	30		
11 and up	7	16	23		
Total	**56**	**38**	**94**		

Note. *Significant at α = .05

supported the findings of Walag et al. (2020), which explained that there were higher levels of self-efficacy beliefs among junior high school science teachers who teach biology compared to teachers teaching chemistry and physics. Furthermore, this study confirmed that even pre-service science teachers assigned to teach biology had **high** levels of self-efficacy.

Therefore, teachers having **very high** and **high** levels of self-efficacy beliefs may have been provided with enough support from the schools they are affiliated with, while teachers with **moderate** levels of self-efficacy beliefs may have received less support to carry out tasks and deliver the lessons to attain desirable academic and professional outcomes. The sufficiency of the support provided to the teachers may have contributed to their levels of self-efficacy beliefs.

Relationship Between Perceived Teaching Styles and Other Variables

Teaching styles and sex

In this study, the Chi-square test for independence was employed to examine the relationship between variables. **Table 3** adapts the classifications of teaching styles according to the focus of instruction. The **facilitator** and **delegator** teaching styles are considered learner-centered, whereas **expert**, **formal authority**, and **personal model** are teacher-centered teaching styles (Grasha, 1994). **Table 3** shows the relationship between the respondents' perceived teaching style and sex.

As shown in **Table 3**, there is a significant relationship between the two variables with a Chi-square value of $x^2(1, n = 94) = 5.10$, $p = .024$. Therefore, the $H_{o1,}$ which states that there is no significant correlation between sex and teaching styles, was rejected.

The findings show that sex influenced the perceived teaching styles of the teacher-respondents in this study. Female teachers had a higher chance of being **facilitators** and **delegators,** whereas male teachers were more likely to become **experts**, **formal authorities**, and **personal models**.

The result is contrary to the findings of Sabado et al. (2019) that male teachers had a higher chance of being **delegators** compared to females. However, the findings corroborated Dash et al. (2020) that sex was a predictor of teaching style and female teachers were less authoritative compared to male teachers. In line with the results, female teachers focused more on learner-centered teaching styles, whereas male teachers were more inclined toward teacher-centered teaching styles. This result might be because male teachers are better at establishing authority in the classroom, while female teachers are more facilitative in delivering their lessons.

Teaching styles and years of teaching

Table 4 indicates the relationship between the number of years of teaching experience and teaching styles. The number of years of teaching was divided into three categories so that teachers were classified as having one to five years of experience, six to ten years, or eleven years or more of experience.

It is clearly evident, with $x^2(2, n = 94) = 10.76$, $p = .005$, that there is a positive association between teachers' teaching experience and their preferred teaching styles, and thus, H_{o1} was rejected. The result means that teachers with fewer than ten years of teaching experience exhibited the **facilitator** and **delegator** styles, whereas teachers with more than ten years of experience exhibited the **expert**, **formal authority**, and **personal model** styles.

The findings may suggest that when teachers gain more experience in the classroom, there is a higher possibility of gaining confidence and establishing themselves as the authority or someone in command. Experienced teachers had more opportunities and experience to set their examples and guide students to meet their expectations. The result is contrary to the results of past studies that there was no significant relationship between teaching style, age, and years of experience. However, the result agreed with the findings of Dash et al. (2020) that teaching experience was positively correlated with teaching styles. Moreover, Hosseini Fatemi and Raoufi (2014) found that more experienced teachers employed **expert** and **personal model** styles. Experienced teachers were more conversant with course materials and operated as experts who knew how to successfully convey information with less student-teacher interaction. Therefore, teachers who have less than ten years of experience are more knowledgeable about promoting active learning processes, interactive pedagogic practices, and improved student-teacher interaction than more seasoned educators. Teaching

Table 5. Chi-square analysis on the teaching styles and the number of trainings attended by the respondents

No. of trainings	Facilitator/delegator	Expert/formal authority/personal model	n	Test statistics	
				Computed x^2	p-value
1 to 10	16	20	36	8.49	.014*
11 to 20	21	14	35		
21 and up	19	4	23		
Total	**56**	**38**	**94**		

Note. *Significant at α = .05

Table 6. Chi-square analysis on the teaching styles and type of school of the respondents

Type of school	Facilitator/delegator	Expert/formal authority/personal model	n	Test statistics	
				Computed x^2	p-value
Private	29	10	39	6.05	.014*
Public	27	28	55		
Total	**56**	**38**	**94**		

Note. *Significant at α = .05

experience improves the expertise and pedagogic practices in maintaining command in the classroom as perceived and exhibited by seasoned teachers.

Teaching styles and number of trainings attended

The association between the teaching styles and the number of training attended by the respondents is presented in **Table 5**.

Table 5 indicates that as the number of training attended by the teachers increases, the more the teachers perceive themselves as using learner-centered teaching styles. Teachers most likely become **facilitators** and **delegators** with an increasing number of teacher training. The Chi-square value of $x^2(2, n = 94) = 8.49$, $p = .014$, shows significant results rejecting the H_{o1}. Thus, this proves the interdependence between the number of teacher training and the perceived teaching styles of the respondents. This result suggests that pedagogy and content-focused courses boost teachers' confidence and provide them with recent theories to keep their knowledge up to date. Their teaching styles are influenced by the professional activities related to teaching and learning they are involved in. The result agrees with the findings of Sabado et al. (2019) that seminars or training attended contributed to the teaching style, and teachers with higher education degrees have more learner-centered teaching approaches. Further, this is in line with the result of Arifani (2021), revealing the link between blended professional training and teachers' creativity and teaching effectiveness. This result also agreed with Dash et al. (2020) that there should be an emphasis on faculty development programs in offering structured training and teaching skills to assist teachers in their journey from lecturer to **facilitator**, a shift from the traditional apprenticeship style of teaching toward more learner-centered teaching.

Therefore, the number of professional development trainings encourages a more learner-centered approach. Hence, as the number of professional development training courses attended increases, the chances of implementing learner-centered teaching styles increase.

Teaching styles and type of school

The type of institution where the respondents are currently affiliated was also tested to investigate its correlation with the teaching style of the teachers. **Table 6** shows the relationship between the respondents' type of institution and perceived teaching style.

Table 6 reveals the teachers' perceived teaching style according to the type of institution they are currently employed in. The significant relationship of the two variables with a Chi-square value of $x^2(1, n = 94) = 6.05$, $p = .014$ was established. This means that H_{o1} was rejected.

A large number of private school teachers, 29 (74.36%), were identified to be **facilitators** and **delegators,** while public school teachers were almost equally distributed among all the teaching styles. However, public school teachers were more likely to exhibit teacher-centered teaching styles because, as noted in the previous variable, they are more experienced teachers with a reputation for being the people in charge.

This result contradicted the findings of Yıldız and Karakullukçu (2019) that teachers in both public and private schools were found to use teacher-centered instructional approaches. The result likewise partly negated the results of Hosseini Fatemi and Raoufi (2014), wherein public school teachers adopted **expert** and **personal model** styles significantly different from the private school teachers. The public school instructors in this study employed an almost equal distribution of teaching styles, with only one difference. On the other hand, this study partly affirmed the results of Hosseini Fatemi and Raoufi (2014) that private school teachers maintained an active learning process by employing a learner-centered methodology in teaching. In addition, this result supported the results of Canto-Herrera et al. (2009) that teachers in public schools were more likely to exhibit **expert** teaching, while teachers in private schools were significantly more **facilitators** and **delegators** than teachers in public schools.

Overall, private school teachers were more exposed to the trend of more learner-centered approaches to teaching, while public school teachers can adopt any of the styles of teaching, but it is noteworthy that their experience in the profession may provide them with a higher chance of having teacher-centered teaching styles.

Teaching styles and level self-efficacy beliefs

Table 7 shows the association between the teachers' level of self-efficacy and their teaching styles.

Table 7. Chi-square analysis on the teaching styles and self-efficacy of the respondents

Level of self-efficacy	Facilitator/delegator	Expert/formal authority/personal model	n	Test statistics	
				Computed x^2	p-value
Very high	30	10	40	6.88	.009*
Moderate to high	26	28	54		
Total	**56**	**38**	**94**		

Note. *Significant at α = .05

Table 8. Perceived teaching styles of the students

Teaching style	Responses
Expert	'very knowledgeable with the topics' 'has the expertise to teach the students' 'conceptualizes and an analytical teacher' 'provides handouts that are well-organized' 'processes knowledge that the students need' 'giving examples to the lesson which make us understand the topic' 'well informed and can teach with confidence and knowledge in the topic' 'explains everything in detailed information without reading it from her presentation' 'provides only short descriptions and explains everything very clear and detailed without a copy to read aloud'
Facilitator	'helps us find the right answers' 'asks questions during discussions' 'makes her encounters very interactive as possible' 'good at teaching and asking questions to the students' 'gives, guides, motivates, manages groups, and encourages students to develop criteria' 'always ready to help and assist students on topics/lessons that are hard for most students to understand'
Personal model	"She utilizes her expertise in science and her personal experiences to enhance our learning experience. It not only gives students more understanding on the topic but also makes the lesson more memorable."

As seen in **Table 7**, the Chi-square value of $x^2(1, n = 94) = 6.88$, p = .009 was found to be significant. This result rejects H_{o1}. There is a significant relationship between the self-efficacy of biology teachers and their teaching styles.

Teachers with **very high** levels of efficacy are more likely to be more of the **facilitator** and **delegator** type, while teachers with **moderate** to **high** levels of efficacy are more likely to have **expert**, **formal authority**, and **personal model** teaching styles.

This result may imply that self-efficacious biology teachers are more confident in letting students construct their knowledge and explore their experiences. Self-efficacious biology teachers only act as facilitators in the teaching-learning process and provide opportunities for the students to make meaning of the learned concept on their own. The report did not agree with the findings of Kaya et al. (2020) that teachers were more confident in using teacher-centered approaches to teach science rather than learner-centered approaches. On the other side, this report corroborated with Arifani (2021) that more confident teachers had better teaching styles and could overcome learning difficulties. Similarly, Sabet et al. (2018) discovered the link between teachers' self-efficacy and their teaching styles. The result supported Buzzai et al. (2022) that teachers' efficacy for inclusive practices was a direct positive predictor of motivating teaching styles. Lastly, Canto-Herrera (2009) was supported as proved by the result that maintaining correspondence between the teaching style and efficacy achieves a satisfactory effect on the subject matter.

Therefore, teachers with a high level of self-efficacy had teaching practices that focused on their connection with their students. Hence, they favor learner-centered teaching styles, placing greater emphasis on teaching cognitive skills through interaction.

Students' Feedback on Teaching Styles

The feedback of the students was recorded in the evaluation of the teaching styles of their teachers. The students were given the following descriptions of each teaching style and answered the 2-item survey as their evaluation. After gathering the data, **Table 8** shows the responses of the students after reading and evaluating the performance of their teachers.

As seen in **Table 8**, most of the student respondents (56.25%) observed that their biology teachers are **experts** in their classrooms. This is followed by **facilitators** accounting for 37.5%, and the remaining 6.25% accounts for the **personal model** style of teaching.

The students perceived their teachers as someone who is the more knowledgeable individuals in the classroom who interact with them. The student-respondents viewed their teachers as someone who could provide the necessary knowledge and skills for them to achieve the intended outcomes in their biology subject.

The students responded to the second question of the survey regarding their preferred teaching styles to be implemented during biology class, as seen in **Table 9.**

In **Table 9**, students preferred the **expert**, **facilitator**, and **personal model,** with 30.77% responses for each. The **expert** and **personal model** styles are both teacher-centered teaching practices. Hence, students prefer to be provided with all of the information and demonstrations to attain the desired outcomes in the subject. A **facilitative** teaching style was also preferred by the learners. Hence, students may have valued the exploratory nature of the subject matter and guidance during

Table 9. Perceived teaching styles of the students

Teaching style	Responses
Expert	'someone who conceptualizes and analyzes' "I like my teacher with expertise to their students' needs." 'teachers who can understand our level and that s/he the one to help us in understanding the lessons' 'a teacher whose competent and sure with what she is teaching will allow us to trust in the teacher and it allows us students to learn more'
Facilitator	'more options and alternatives if ever we have any difficulties in our topics' 'allow the students to engage in the discussion and allow both the teacher and the students to express their thoughts and ideas freely to emphasize how we are also given the freedom to share' 'patient with students and teachers that are always on point when teaching' "I like myself to explore more subjects a lot so facilitator is for me."
Personal model	'encourages students to look up to the teacher, and to emulate the instructor's approach' 'relate the topic to real-life situations and I believe it can allow more interactions with the teacher throughout the class "I learn better if someone shows me how to do something compared to if someone just explained it to me." 'encourages the students to observe'
Delegator	"It enables independence for students. As upcoming senior high school students, autonomy in learning is a must and should be practiced more. This teaching style shows students that spoon-feeding is not applicable anymore in future grade levels."

the application of skills, as this plays a role in student achievement.

The result implies that students want the lessons to be explained extensively and provided with actual demonstrations before they can conduct the application of knowledge through laboratory work and reach the expectations or standards of the teachers.

The results imply that, given the intimidating nature of the teaching styles, setting examples for the actual application of the skill gave the students the advantage. Consultations and support were also needed by the students in carrying out tasks.

Given that the most perceived teaching style by the teachers was **facilitator,** the most perceived teaching style by the students was **expert,** and the most preferred teaching styles by the students were **expert**, **facilitator**, and **personal model**. The teachers' self-evaluation and student evaluation were not aligned according to the results. This may be due to learners' desire to be supplemented with their demands and become direct receivers of the lessons. For the teachers, the new educational trend is the shift from a teacher-centered to a learner-centered learning process.

In conclusion, the self-evaluation of teachers did not match the evaluation of the students. The students preferred to be provided with the necessary information by the teachers rather than taking the time to be given independent learning. Students' impressions may suggest that a classroom demonstration is an approach suitable for students to perform better in biology class. This is extremely useful when conducting experiments. When students replicate what the teacher does, they feel more effective in completing the scientific methods and complying with the intended learning outcomes.

The mismatch between the perceived teaching styles of the teachers and the preferred teaching styles of the students necessitates the proper intervention of teachers. This is to align not only the preferences of the students but also the demands of the content of the subject matter. For the teachers to be provided with the appropriate teaching strategies, a proposed list of teaching strategies and teaching styles was provided in this study.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

As the study has demonstrated, the majority of the biology teachers were female, largely from public schools, new to the teaching profession, and had less teaching-related training. It was discovered that the majority had a **high** level of self-efficacy and a **facilitator** teaching style. The respondents' reported teaching styles were shown to be significantly correlated with their sex, number of years of teaching experience, number of training, type of school they taught at, and degree of self-efficacy. The biology teacher's method of instruction was viewed by the students as an **expert** style. According to students' comments, biology professors' most favored teaching philosophies were **expert**, **facilitator**, and **personal model**.

The teachers' reported teaching styles were influenced by their demographics and opinions about their efficacy. According to the study's findings, perceived teaching styles of teachers can be predicted by a teacher's sex, years of teaching experience, number of teaching-related training, and the kind of school. Teachers' perceived teaching approaches are positively correlated with their degrees of self-efficacy beliefs. However, there is a discordance between the teachers' self-reported teaching styles and the perceived teaching styles of their students. The adoption of policies and curricula that do not align with the needs of both instructors and students occurs as a result of the teachers' information being disregarded. Therefore, before implementing government programs for pedagogical enhancements and interventions, the government should consult with teachers who have direct contact with the learners. The provision of professional development opportunities should be data-driven based on the needs of specific subject matter. Thus, biology teachers should not be limited to being recipients and followers of what has been practiced but should be the data source where the education leaders should focus and account for the needs and concerns to pinpoint the gaps in the practices of the teachers. In the end, the teacher's role is to promote students' learning and should serve as the embodiment of lifelong learning.

Contribution to Knowledge

This study is focused on contributing to the inadequate studies with biology teachers and addressing their specific needs for the betterment of their instructional practices and overall professional development. This study substantiated the significant correlation between biology teachers' teaching styles to their demographic profile and their levels of self-efficacy, which gives teachers and school leaders an in-depth understanding of how sex, years of experience, type of school, and training frequency can impact pedagogical approaches. In addition, a mismatch between the perceived teaching style of the teachers and the perceived and preferred teaching style of the learners was discovered. This only validates the need for continuous reflection and alignment of teaching strategies to meet learner needs. Moreover, this study emphasized the central role of biology teachers' level of self-efficacy as a contributing factor to shaping their pedagogical preferences and teaching practices. The nature of this study corresponds with existing theories but is often underexplored when it comes to contextualizing it with biology teachers, in that high self-efficacy is linked to learner-centered approaches, while low self-efficacy is often linked to teacher-centered approaches. The multimodal method of using the TSI and TSES provides future researchers with a replication or adaptation of the assessment in other disciplines or educational contexts. Substantially, the findings advocate for policy revisions toward data-driven professional development resolutions and a more participatory model of educational reform that values teachers' perspectives as frontline agents of change. Ultimately, feasible solutions for administrators, policymakers, and teacher training institutions may be rooted in this research to address the gap in understanding how teacher demographics and self-efficacy interact to influence classroom instruction through better-aligned pedagogical strategies.

Recommendations

Based on the findings of this study, it is advised that the education sector motivates teachers to recognize their teaching methods and incorporate them into the decision-making process for pedagogical improvements, ensuring their styles correspond with their subjects and the requirements of the students. Additional professional interventions and prompt feedback from administrators should be given precedence to readjust teachers' strategies and enhance their self-efficacy. This is to influence their interactions and teaching methods with students and create more chances for students to actively become more involved and committed to their learning. Ultimately, future researchers should broaden the scope and timeframe of their investigation into teaching styles alongside other factors like students' academic achievement and self-efficacy.

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Ethics approval: The author stated that the study was approved by the Research Ethics Committee of the College of Social Sciences at the University of the Philippines Cebu on June 21, 2022, by completing the research ethics checklist for investigations involving human participants. This was done to safeguard the safety and secrecy of all respondents in the study. Following approval, letters were sent to the schools requesting permission to perform the study. Following the agreement, teacher respondents were informed to obtain their informed consent. The authors further stated that the informed consent form describes the purpose of the study, data collection procedure, confidentiality, study participation, withdrawal, and contact information for the researcher. The respondents were informed that their participation in this study was entirely voluntary and that they might opt out at any time. Each respondent's name was replaced with a personal identification number.

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