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Science Teaching and Learning Conceptions towards Teachers' Sense of Efficacy

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Abstract Teachers' affordances in facilitating science classes which involves their efficacy in teaching strategies and assessment practices, classroom management, and student empowerment impinge their deliberate self-efficacy and attitude in raising desirable scientific attributes among students in response to the newer philosophy of science teaching and learning. The following are the highlights of the findings of this study: (1) the respondents hold efficacious standpoints in teaching and learning science in the newer philosophy of science teaching; (2) the respondents are efficacious in teaching strategies and assessment practices, classroom management, and student empowerment. These concordances are manifestations of their standpoints in an effective science teaching and learning; and (3) the respondents' general standpoints in teaching and learning science is proportional to their efficacious viewpoints in employing teaching strategies and assessment practices, classroom management, and student empowerment.

Keywords: *science teaching and learning, teachers' efficacy*

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1. Introduction

Teachers play a critical role in providing individuals with the knowledge and skills required by age in today's world where great changes in science and technology are occurring [1]. Progress in the field of education develops the industry all over the world while developments in the industry force education to change [2]. Teachers' duties and responsibilities are growing in this fast changing and developing world [3]. The way teachers view science and their experiences in learning science affect the way they implement science in the classroom [4]. Hence, teacher training has been identified as a key element in enabling teachers to implement reform-oriented practices. In connection thereto, teachers' self-efficacy and attitude towards the teaching profession are important factors that have a direct impact on educational quality in order to raise qualified students [5].

Bandura's Social Cognitive Theory [6] reveals several capabilities that drives a person's motivations. These capabilities include symbolizing, forethought, vicarious, self-regulatory, and self-reflective. As such, students complete their tasks in an engaging environment, behaviors, and personal factors. Specifically, Bandura refers to a person's views on their ability to achieve a particular outcome as self-efficacy. In relation thereto, the concept of self-efficacy derived from Bandura's Social Cognitive Theory of behavioral change. A study defined teachers' sense of efficacy to teachers' confidence on their ability to successfully complete tasks, obligations, and challenges associated with their professional roles, e.g., didactical tasks, managing discipline problems in the class, etc. [7,8]. In this sense, teachers' self-efficacy is a powerful influence that explains their behaviors and influences students' motivation. Many efforts have been made by educators and researchers to comprehend and quantify teachers' sense of efficacy. Self-efficacy is one of the topics that researchers use to predict motivation in addition to explaining teachers' behaviors [9]. Teachers' efficacy influences several aspects in the teaching-learning process including classroom environment, student performance, and teacher practices [10].

Furthermore, a person perceives, assesses, and acts in relation to a given phenomenon, building concepts. It is the representation of thinking about a phenomenon that contributes to the formation of personal theories [11]. In

the case of teachers, conceptions constitute their implicit theories, that is, their individual and unconscious constructions are results of their sociocultural relations and experiences in academic and school environments, as well as their objectives and methods of teaching [12]. This context reveals that in general, teaching and learning concepts can be defined as beliefs about teaching that guide a teacher's perception of a situation and shape actions. Approaches to teaching, on the other hand, are the methods by which beliefs are put into action [13].

The way teachers use their beliefs about knowledge and learning to teach and the beliefs they bring to their professional experience may serve as barriers or facilitators of learning, shape their practice, and serve as heuristics for teachers embedded in the ever-changing contexts of classrooms [14]; hence, teachers' self-efficacy is a context-specific judgment [6,15]. As a result, science teachers' self-efficacy beliefs differ from one integrated teaching situation to another. Thus, understanding the main antecedents of self-efficacy may thus have significant ramifications in teachers' conception.

1.1. Objectives of the Study

This study is designed to determine the (1) teaching and learning conceptions of science teachers, (2) determine the sense of efficacy of science teachers, and (3) evaluate significant relationship of teaching and learning conceptions, and the sense of efficacy of science teachers.

1.2. Theoretical Framework of the Study

The conditions and parameters of this study are anchored on Bandura's Social Cognitive Theory and the associated Theory of Self-efficacy [6]. Self-efficacy, one of the most central mechanisms, has an influence on human behavior. From this vantage point, teachers' self-efficacy refers to the belief that teachers hold about themselves in executing instructional practices that lead to positive student learning outcomes [16]. It is the teachers' self-perceived level of their ability to achieve favorable learning outcomes in the classroom [17]. Teachers' self-efficacy impacts students' achievements, increases job satisfaction, and diversifies the usage of technological tools and innovative teaching methods [14,18,19].

Individuals possess self-beliefs that enable them to exercise a measure of control over their thoughts, feelings, and actions. To analyze further science teaching and learning conceptions, which can potentially enhance self-efficacy among science teachers, the two efficacy sources proposed by Bandura were extensively reviewed. The sources that can produce changes in self-efficacy include: (1) enactive mastery experiences and (2) vicarious experiences. Enactive mastery experiences are authentic experiences in which one demonstrates the capability to succeed in the task and considered to be the most powerful source in fostering sense of self-efficacy. Such experiences have been discussed in literature: scientific inquiry projects, simulated lessons, and successful participation in science teaching practice [4]. The second source, vicarious experiences occur when seeing or visualizing a person perform a task successfully can enhance observers' belief in their capability. The advantages of this source have been stressed: heavy emphasis on hands-on activities, cooperative learning, discussion, and modeling both teaching strategies and attitudes [4,20,21].

2. Methodology

This study employed the Quantitative-descriptive research design. This design fits the research objectives as it gathered needed information to systematically describe the research problem. The respondents of this study were the science teachers of Schools Division of Quirino who are currently teaching science in the elementary, junior, and senior high school.

Moreover, a research questionnaire was utilized to collect the data. This assisted the researchers in determining the consensus of the respondents on their teaching and learning conceptions, as well as their sense of efficacy in teaching science. The questionnaire was divided into three sections: (1) the respondents' educational background and grade level taught, (2) the respondents' teaching and learning conception, and (3) the respondents' sense of efficacy. Furthermore, for sections 2 and 3 of the questionnaire, an instrument is used to ask participants to rate their teaching and learning conceptions, as well as their sense of efficacy.

3. Results and Discussion

3.1. Teaching and Learning Conceptions of Science Teachers

Presented in Table 1 are the concordances of the respondents to the general teaching and learning in science. As presented in the table, the respondents vouched *very much true of me* on the indicators 1,2,3,5,6,7,8,9,11,13,14,15: all for the notion that good teachers encourage students to think for answers and solutions. Teachers' job is to correct students' misconceptions about learning through verification and thorough discussion as effective science teaching encourages more discussion and hands-on activities. Good teaching occurs when the teacher talks the most and frequently demonstrates activities. The goal of teaching is to help students construct knowledge from their learning experiences. Science teaching provides students with accurate and complete knowledge through discovery and inquiry. Students' ideas are valuable and should be taken into account. Each learner is unique and deserves educational procedures and processes tailored to their specific needs.

On the other hand, the respondents generally vouched *true of me* on the indicators 4,10,12 which connotes that it is the responsibility of teachers to supervise the students about their learning through verification and in-depth discussion using discovery and inquiry. Aptly, science education provides students with accurate and complete knowledge. This substantiates the first efficacy source proposed by Bandura [6] and seconded by

Seneviratne et al. [4]. It is postulated that the enactive mastery experiences are genuine experiences in which one demonstrates the ability to complete a task successfully, thereby fostering a sense of self-efficacy such as scientific inquiry projects, simulated lessons, and successful participation in science teaching practice [22].

3.2. Teachers' Sense of Efficacy

Table 2 presents the teachers' sense of efficacy as to teaching strategies and assessment practices. As presented in the table, the vouched concordances of the respondents are *very true to me*. This connotes that the respondents' good questioning and varied assessment are linked to better learning. The foregoing results construe with the findings that teachers' sense of efficacy level has been linked with and considered a contributing factor to student achievement [7,23,24,25].

Table 3 presents the teachers' sense of efficacy as to classroom management. As presented in the table, the respondents concurred *very true of me* in all the indicators. This signifies that good art of questioning and integrating varied type of assessment leads to greater impact of learning as to the classroom management. This supports the findings that classroom management is not really about teaching; it is about a teacher's capacity to create and cultivate learning and student development in a space. Students' build opportunities and access to learning. This allows inquisitive interactions about power structures and hierarchies that shape what happens in society and school [26,27]. Teachers' efficacy beliefs do not only influence teachers' behaviors in the classrooms, but also teachers' efficacy beliefs affect the success of the teachers' classroom management [25]. In general, it is concluded that classroom management is not an easy task. Efficacious teachers can manage the classroom effectively and can establish organized classrooms that positively influence student learning and behaviors. Teachers with high efficacy levels can manage conflict with their students and are more likely to use different management styles in their classrooms [28].

Table 4 presents the teachers' sense of efficacy as to student empowerment. As presented in the table, the respondents vouched *very true of me* in all the indicators. This underscores the teachers' motivational techniques in engagement to parents and guardians, an extension of classroom teaching-and-learning that impacts students' good performance. The results revealed a connection on the use of modeling specific set of professional behaviors of scientific and motivational way of teaching which has been categorized as powerful vicarious experience in raising self-efficacy beliefs. This corroborates the findings of reference [29] stating that learning strategy is a set of tasks through which learners plan and organize their engagement in a way to facilitate knowledge acquisition and understanding as well as enhancing the learning process with appropriate learning strategies that may contribute to better outcomes and performances [30]. Several studies examined the relation between teachers' sense of efficacy and student achievement. The level of teachers' sense of efficacy has been linked and considered a contributing factor to student achievement [2,4,25].

Moreover, it was said that one of the teachers' role in the newer science instruction is to follow-up every aspect of learning milestones made by the students. This is believed to alleviate the classroom routines in relation to the didactic triangle: teacher, knowledge, and students [31,32,33].

Table 1. General Teaching and Learning Conceptions of Science Teachers

Teaching and Learning Conceptions		NTM	TM	MTM	VMTM	Mode
1	Good teachers encourage students to think for answers and solutions.	-	-	25	33	Very much true of me
2	Teachers' task is to current learning misconceptions of students through verification and thorough discussion	-	6	25	27	Very much true of me
3	Effective science teaching encourages more discussion and hands-on activities	-	4	12	42	Very much true of me
4	Good teaching occurs when the teacher talks most and demonstrates activities often	15	17	16	10	True of me
5	The focus of teaching is to help students construct knowledge from their learning experiences	-	2	17	39	Very much true of me
6	Science teaching provides students with accurate and complete knowledge through discovery and inquiry	-	4	20	34	Very much true of me
7	The ideas of students are important; hence, they should be considered	-	4	18	36	Very much true of me
8	It is best if teachers exercise as much authority as possible in the classroom	7	13	23	15	Much true of me
9	Students must have ample opportunities to explore, discuss, and express their ideas to make an optimized learning condition	-	4	21	33	Very much true of me
10	Learning to teach simply means practicing the ideas from lecturers without questioning them	16	19	10	13	True of me
11	Good classrooms have democratic and acceptable atmosphere that stimulates students to think, interact, and discuss	-	2	24	32	Very much true of me
12	Students have to be called on all the time to keep them under control	10	19	20	9	True of me
13	Every learner is unique and deserves educative procedures and processes specific to his particular needs	-	5	23	30	Very much true of me
14	Good students keep quiet and follow teachers' instruction in class	11	12	21	14	Much true of me
15	Different objectives and expectations in learning should be applied to different students	1	10	19	28	Very much true of me

Legend: NTM-not true of me; TM-True of me; MTM-Much true of me; VMTM-Very much true of me.

Table 2. Teachers' Sense of Efficacy as to Teaching Strategies and Assessment Practices

Teaching Strategies and Assessment Practices		NTM	TM	MTM	VMTM	Mode
1	Good questions are equated to greater learning	-	7	26	25	Very True of Me
2	Varied assessment strategies are equated to greater learning	-	7	23	28	Very True of Me

Legend: NTM-not true of me; TM-True of me; MTM-Much true of me; VMTM-Very much true of me.

Table 3. Teachers' Sense of Efficacy as to Classroom Management

Classroom Management		NTM	TM	MTM	VMTM	Mode
1	Good questions are equated to greater learning	-	6	16	36	Very True of Me
2	Varied assessment strategies are equated to greater learning	-	7	18	33	Very True of Me
3	Good questions are equated to greater learning	2	12	18	26	Much True of Me

Legend: NTM-not true of me; TM-True of me; MTM-Much true of me; VMTM-Very much true of me.

Table 4. Teachers' Sense of Efficacy as to Student Empowerment

Student Empowerment		NTM	TM	MTM	VMTM	Mode
1	Students are engaged through proper motivational techniques	-	4	20	34	Very True of Me
2	Students need to believe in themselves so they can do well in school works	-	4	20	34	Very True of Me
3	Teachers can work with parents and guardians to fully optimize learners' potentials	2	3	20	33	Very True of Me

Legend: NTM-not true of me; TM-True of me; MTM-Much true of me; VMTM-Very much true of me.

Table 5. Relationship between Teaching and Learning Conceptions, and Sense of Efficacy of Science Teachers

		Teaching Strategies and Assessment Practices	Classroom Management	Student Empowerment
Teaching and Learning Conceptions	Correlation Coefficient	.277	.476	.311
	p-value	.035*	.000**	.017*

*significant at .05 level; **significant at .01 level.

3.2. Teaching and Learning Conceptions, and Sense of Efficacy of Science Teachers

Table 5 presents the correlation coefficients of teaching and learning conceptions, and sense of efficacy of science teachers: tests posted significant relationship. Pearson r posted a significant correlation at .01 level on classroom management while significant correlation at .05 level between teaching strategies and assessment practices and student empowerment. These implies that the respondents teaching and learning conceptions emphasize the relationship of teaching strategies and assessment practices, classroom management, and student empowerment. The following data substantiate the findings of reference [34] that teachers with high efficacy expend more effort in teaching and show greater persistence in the face of obstacles. In addition, they are more likely to try new instructional approaches in an effort to find better ways of teaching and are more willing to work with students who are experiencing difficulties. Based on the previous research, teachers' sense of efficacy has been found to be correlated with teachers' performance beliefs and willingness to improve their methods of instruction using inquiry [21,24,35,36]. Furthermore, it was concluded that highly efficacious teachers attributed their high sense of teaching efficacy to their increased knowledge of teaching strategies, i.e., inquiry, interactive, and hands-on learning [37,38].

4. Conclusion

The following conclusions are drawn based on the interpreted data.

1. The respondents hold efficacious standpoints in teaching and learning science in the newer philosophy of science teaching;
2. The respondents are efficacious in teaching strategies and assessment practices, classroom management, and student empowerment. These concordances are manifestations of their standpoints in an effective science teaching and learning.
3. The respondent' general standpoints in teaching and learning science is proportional to their efficacious viewpoints in employing teaching strategies and assessment practices, classroom management, and student empowerment.

5. Implications to Theory and Practice

The science teachers' efficacy is not only the factor that determines the students' engagement but also a crucial component for the meaningful engagement of students in learning science. The science teachers' efficacy can be better translated in the practice inside the classroom contexts while bringing conducive learning environment. Professional growth training could help teachers to increase their self-efficacy on science teaching as well as towards proper student engagement. Science teachers should have appropriate training about dealing the science topics with scientific method principle which will help to develop science concept among the students. The study was carried to a specific region with limited sample, implementing this study to larger sample may provide some more depth understanding of teacher's self-efficacy on aspects of student engagement including demographic

aspects in the study would provide more understanding about level of efficacy of science teachers. The mixed method may also give more contextual understanding on science teachers' self-efficacy towards engaging students.

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