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Scientific Learning Motivations as Predictors of Pre-service Elementary Grade Teachers' Authentic Assessment Practices in Science

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Abstract Teachers, as life-long learners, hold personal pedagogical and andragogical motivations towards learning which manifest in their procedures and practices towards specific disciplines. This study is aimed to determine the level of scientific learning motivations and assessment practices in science of pre-service elementary grade teachers and ascertain whether the respondents' scientific learning motivations predict their assessment practices in the subject. Scientific learning motivations in this study include intrinsic and extrinsic goal orientation, task value, control of learning beliefs, expectancy, and affective components. Employing adopted questionnaires in a Descriptive-Predictive Research design, the respondents' scientific learning motivations and assessment practices in science were determined and evaluated. Results showed that the pre-service elementary grade teacher-respondents had good to very good motivations in science learning and assessment practices towards the subject. Among the motivational factors in science learning, only expectancy component is related to their affordances in authentic assessment in science. Furthermore, self-efficacy for learning (an expectancy component of scientific learning motivations) was specifically seen to predict the pre-service elementary grade teachers' affordances of authentic assessment practices towards the subject.

Keywords: *assessment practices, scientific learning motivations, elementary science, pre-service elementary grade teachers*

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1. Introduction

Motivation has been recognized as an essential construct in science education [1,2]. It has been regarded as a driving force that stimulates and affords direction from thoughts, feelings, and actions. Motivation is often presented as a 'subsequent order' variable being very much dependent to attitude as well as perceived goals, needs, and values. Attitude is known to be an important determiner of subsequent behavior. Thus, attitude towards science learning developed at school can play a major role in all types of behavioral patterns. Motivation, like other attitudinal behaviors, covers many features and one such feature is motivational orientation; hence, motivational orientation acts as a powerful tool that encourages a person to engage in a task. Specifically, motivation refers to the disposition of students to find academic tasks relevant and worthwhile and to derive the intended academic benefits from them [2-6]. Motivational orientations consist of several constructs like intrinsic and extrinsic motivation, task value, control of learning beliefs, self-efficacy, and test anxiety [3].

Pre-service teacher's motivation towards science learning and its influence on their engagement and behavior are apparent in various researches. Behavior and attitude in learning that underscore students' motivation in science learning are very much related to students' practices and activities towards learning science [2-3,6]. In addition, teachers who are self-determined through intrinsic motivation are more likely to support students' autonomy. Intrinsic motivation is associated with several desirable assessment outcomes in relation to academic achievement including greater creativity, enjoyment, quality of work, increased attention, persistence, and study skills [7]. Thus, there are good reasons for developing and sustaining intrinsic motivation of pre-service teachers.

Other important construct of motivational orientations is self-efficacy. According to Bandura's Social Cognitive Theory, self-efficacy is one's beliefs about his or her own

capabilities in learning and performing tasks at specific levels [8]. Self-efficacy is especially important in learning difficult subjects such as biology, physics, and other science-related subjects. Students with high self-efficacy are often confident enough to take challenging tasks such as performing experiments, writing journal reports, and simulations; all these and more are examples of authentic assessment. Thus, authentic assessment is a type of assessment in which students are asked to perform real-world tasks that demonstrate meaningful application of essential knowledge and skills [9].

Understanding pre-service teachers' expectancy value related to motivational beliefs towards science learning and their intentions to integrate concepts behind motivational theories and strategies to various teaching tasks such as assessing students' outcome could help teacher educators design better professional preparation that hones activities that best sustain a holistic classroom teaching-and-learning including assessing students' outcome. Knowing the motivational factors that best predict pre-service teachers' assessment practices in science could provide useful information to professional preparation programs seeking to design learning experiences that influence pre-service teachers [10]. In this way, evaluating motivational beliefs and studying their relationship with intention to any type of assessment is like conducting needs assessment to better personalize pre-service teachers' professional preparation.

Recognizing the reasons for choosing authentic assessment practices and understanding the associated motivational outcomes with these choices is important because the reasons and motives can influence outcomes of the pre-service teachers. The reasons and motives for choosing to use authentic assessment practices also influence the way the pre-service teachers view themselves, their students, and their peers [11]. Identifying choices and motivational concepts behind assessment practices can influence teacher education programs, as well as the design of curriculum to respond to pre-service teachers' needs, expectations, and motives.

The crux is: pre-service teachers hold pedagogical and andragogical standpoints which are coined from their pre-service education and training. These, however, can be nurtured through continuing professional programs and education. The continued pursuit of revitalizing their own schema in science will redirect their prior standpoints towards better philosophies contributory to the attainment of a holistic school science teaching and learning.

2. Methodology

The Descriptive-Predictive Research design was used in this study with *Ex post facto* as point of inquiry as the phenomenon had been done by the time the study was conducted. This research design fits best in studies which aim is to describe the nature of situations after it had been done and afforded by the respondents and to explore possible causes of a particular phenomenon. Among the various types of descriptive research design, four were rightly applied: survey, in-depth study, correlation, and regression.

This research was conducted at the College of Teacher Education of Quirino State University, Diffun Campus, School Year 2017-2018. A total of 41 respondents were determined using the Lynch Formula. The respondents were the Bachelor of Elementary Education (BEEd) students who taught science classes in their Internship program.

There were two parts of the research instrument of the study: Part 1 dealt with the Scientific Learning Motivation of the respondents which was adopted from the study of Tuana, Chin, and Shieh (2005) while Part 2 dealt with their employment of authentic assessment practice in science. The Part 2 of the questionnaire underwent expert pooling as strategy of validation. The gathered data were treated with mean, Pearson-r, and regression analysis: all were employed in SPSS.

3. Results and Discussion

Results in Table 1 show that the respondents vouched *true of me* and *very true of me* which indicate a good to very good state of learning motivations in science among the respondents. It can be noted further that they own very good motivations along their control of learning beliefs, task value, and intrinsic goal orientation. This concordance could be attributed to the varying internal level of the respondents' attitude that drives their motivation into its optimum level as theorized by Ryan and Deci in their Cognitive Evaluation Theory; hence, motivation given to a student-learner must fall within his current level of competency [12].

On the other hand, there has been a decline in the state of school science education particularly in the elementary level that was attributed to the way science is taught among school children [13,14,15]. If not mitigated and improved, this scientific-educational alienation threatens the notion of scientific identity which could only be recuperated through pedagogical interventions, i.e. demonstrating motivational scientific attitude and acumen and the empirical impact of science to technology and society [2,6].

Table 1. Science Learning Motivation of Pre-service Elementary Grade Teachers

Science Learning Motivation		Mean	Description	Rank
1	Value Component: Intrinsic Goal Orientation	3.29	Very True of Me	3
2	Value Component: Extrinsic Goal Orientation	3.13	True of Me	4
3	Value Component: Task Value	3.36	Very True of Me	2
4	Expectancy Component: Control of Learning Beliefs	3.41	Very True of Me	1
5	Expectancy Component: Self-efficacy for Learning and Performance	3.08	True of Me	5
6	Affective Component	2.82	True of Me	6
Average		3.19	True of Me	

Table 2. Employment of Authentic Assessment Practices in Science of Pre-service Elementary Grade Teachers

Authentic Assessment Practices in Science		Mean	Description	Rank
1	Doing science experiments	2.44	Seldom	11
2	Conducting field research and observation	2.70	Often	10
3	Presenting output from experiments, researches, field works, and observations	3.02	Often	4
4	Writing journal and reports	2.93	Often	6
5	Reading and interpreting scientific papers and research articles	2.79	Often	8.5
6	Resolving scientific problems that have real-world application	2.79	Often	8.5
7	Performing particular skills and competencies, e.g., procedures, delivery techniques, equipment manipulation.	2.98	Often	5
8	Simulation or role plays	2.81	Often	7
9	Exhibiting and displaying complemented works	3.07	Often	3
10	Submitting portfolios	3.26	Always	2
11	Submitting original creative projects	3.28	Always	1
Average		2.92	Often	

Results in Table 2 show that authentic assessment practices in science is not well employed by the respondents in their courses of teaching. The respondents agreed that they seldom use experimentation as methodology in teaching science due to perennial lacking of equipment and apparatus. However, it can be noted that they afforded to employ portfolio, original creative projects, and exhibits and displays in their courses of teaching science.

Table 3. Relationship of Scientific Learning Motivations and Authentic Assessment Practices in Science of Pre-service Elementary Grade Teachers

Scientific Learning Motivation		Authentic Assessment Practices in Science
Value Component: Intrinsic Goal Orientation	Pearson-correlation	-.153
	Sig (2-tailed)	.327
Value Component: Extrinsic Goal Orientation	Pearson-correlation	-.006
	Sig (2-tailed)	.971
Value Component: Task Value	Pearson-correlation	-.156
	Sig (2-tailed)	.316
Expectancy Component: Control of Learning Beliefs	Pearson-correlation	.373
	Sig (2-tailed)	.014*
Expectancy Component: Self-efficacy for Learning and Performance	Pearson-correlation	.534
	Sig (2-tailed)	.005*
Affective Component	Pearson-correlation	.224
	Sig (2-tailed)	.149

*significant at .05 level

Results in the foregoing table show that among the six indicators of scientific learning motivations, only the expectancy components are related significantly to their employment of authentic assessment practices in teaching science.

The foregoing results imply that the greater the affordances of the respondents on controlling their learning beliefs and self-efficacy for learning and performances, the greater is their employment of authentic assessment practice in teaching the subject. Furthermore, it is posted that school science entails a lot of doing – a laborious search for scientific knowledge and scientific-technical know-how honed by employing appropriate learning practices on searching and probing. Moreover, it was claimed that learners' skeptical behavior and attitude in learning underscore their motivation in science learning which are correlated to their practices and activities towards learning science [2,6]. In this sense, science teachers practice what they learned and master during their pre-service education and training as teachers.

Corollary to the aforementioned concordances, it can be noted further that science learning employs higher cognitive and metacognitive learning strategies. When regulated, it can be construed that teachers' scientific attitude and behavior spell their scientific motivation that underpin their teaching and assessment practices [3]. It is in this context that pre-service teachers must be developed with a sound scientific knowledge and know-how in order for them to function well when they are already in the field of teaching.

Table 4. Employment of Authentic Assessment Practices in Science of Pre-service Elementary Grade Teachers

		F-value	Sig
Authentic Assessment Practices in Science	Regression Residual	3.019	.017*[b]
	R-value: .579[a]; R-square=.335; Adjusted R-square=.224		
	Predictors[b] (Science Learning Motivation)	t-value	Sig
	Value Component: Intrinsic Goal Orientation	-.560	.579
	Value Component: Extrinsic Goal Orientation	-.077	.939
	Value Component: Task Value	-.971	.338
	Expectancy Component: Control of Learning Beliefs	1.879	.058
	Expectancy Component: Self-efficacy for Learning and Performance	2.410	.021*
	Affective Component	.271	.788

Legend: *significant at .05 level;
[a]Dependent Variable: Authentic Assessment Practices in Science;
[b]Predictors: Science Learning Motivations.

Results in the foregoing table show that the science learning motivations of pre-service elementary grade teachers predict their employment of authentic assessment practices in science (F-value of 3.019 and p-value of .017) and adjusted R-square of 22.40%. This means that 22.40% of their affordances in authentic assessment in science is coined from their science learning motivation. Specific to this attribution is the respondents' self-efficacy for learning and performance which further predict their employment of authentic assessment in science; the rest of the scientific motivations are not found to predict such employment. The foregoing results confirm the results in Table 3. It can be construed that pre-service teachers need to be shaped with sound scientific knowledge and know-how as part of their pre-service education if our educational system wants to assure sound school science in the future. Nonetheless, educational entities and educators need to ignite the scientific interests of school-children if we want to develop and sustain scientifically inclined learners; thus, honing scientifically inclined citizens of the country [2,6,16]. This is to combat the fact that learners' interests in school-science, as well as hands-on science, is already declining worldwide [17].

Furthermore, the foregoing results exemplify the fact that the greater motivation drive that students develop from a well-constructed and facilitated dynamic learning environment, the faster is their response to every learning tasks. It can be construed that motivation emanates from the drive of the student-learner developed within him. This phenomenon can be explained by the Attitude-Behavior Consistency Theory of Kallgren and Wood [18] and the Cognitive Evaluation Theory of Deci and Ryan [12]. Kallgren and Wood theorized that attitude (predispositions to behavior) and actual behaviors are more likely to align when both attitude and behavior are both constrained to circumstances that happened in the past. Attitudes, that drives motivation, is held strongly around core beliefs [18]. On the other hand, Deci and Ryan theorized that motivation given to a student-learner must fall within his current level of competency [12]. This motivation is used by the learners in their evaluation of the applicability and correctness of their strategy in helping them achieve their goals.

The respondents' affordances on authentic assessment practices in science as influenced by their scientific learning motivations is governed by their concepts of self-efficacy. Self-efficacy is one's beliefs about his or her own capabilities in learning and performing tasks at specific levels [8]. Hence, the respondents may aptly demonstrate their a-priori meaningful applications of assessing essential knowledge and skills [6,9].

4. Conclusion

Based on the results of the study, the following are drawn:

1. The scientific learning motivation among the pre-service elementary grade teacher-respondents of the study is generally good;
2. Authentic assessment practices in science is often employed by the pre-service elementary grade teacher-respondents of the study;
3. The expectancy component of scientific learning motivation is significantly correlated to the pre-service elementary grade teacher-respondents' employment of authentic assessment practices; and
4. Self-efficacy for learning and performance of the expectancy component predicted the pre-service elementary grade teacher-respondents' employment of authentic assessment practices in science.

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