SCIENCE TEACHERS' MOTIVATION TO TEACH: INTRINSIC FACTORS

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The study aimed to investigate the intrinsic factors science teachers perceive important for motivating them to teach and how their perceptions are affected by their gender, marital status, nationality (Bruneian/expatriates), grade level taught, teaching experiences and geographical location of work place. The sample for the study consisted of 351 (109 male and 242 female) science teachers. Five percent of sample teachers were interviewed. A new instrument consisting of 27 items covering three scales (enjoyment, satisfaction and self-actualization) was developed. The factor analysis, discriminant validity, alpha reliability and η^2 analysis supported that the 24 item intrinsic motivation instrument was valid and reliable. All the teachers considered the intrinsic variables to be "important" and "very important". They perceived enjoyment as the most important factor affecting their motivation to teach science. During interview the majority of teachers ranked enjoyment as one of the three most important factors influencing motivation to teach. The female teachers regarded enjoyment and satisfaction factors as more important factors affecting motivation to teach science than the male teachers. The teachers teaching only at one level (lower or upper secondary) perceived enjoyment variables as more important than those teachers who teach at both lower and upper secondary levels. The teachers' perceptions of importance the intrinsic variables were not affected by marital status, nationality, grade levels taught and geographical location of their workplace. Implications and suggestions are also discussed.

Introduction

Teachers are powerful tools for improving quality of education through effective classroom practices (Davidson, 2007). According to Bess (1997), the primary factor that contributes to effective classroom practices is strong motivation. Therefore to bring about a change to an educational system, improvements to improve teacher motivation are essential. A planning for such improvements would require the planner to know the existing state of teacher motivation and factors affecting teacher motivation. This information will inform about the factors that need improvements. Motivation can be classified into intrinsic and extrinsic. The extrinsic motivation of teachers is associated with many extrinsic factors such as salary, working conditions etc. Intrinsic motivation is the motivation contributed mainly by intrinsic factors such as enjoyment, personal satisfaction etc. The intrinsic motivation some extent is enhanced by the extrinsic factors. When studying the existing state of teacher motivation, it is essential to examine both the intrinsic and extrinsic factors affecting

teachers' motivation. Since the number of these factors is large to cover them in one report, this study concentrated on intrinsic factors only; the factors associated with the teachers' inner feelings which stimulate them to give the best performance in their teaching career. Ozcan (1996) proposed that teacher motivation is likely to be enhanced by three types of rewards, in which one of it is intrinsic rewards. He described intrinsic rewards as the inner feeling experienced within the individual such as joy, pleasure and psychological satisfaction.

Several studies have reported that teachers appeared to be motivated by intrinsic factors such as enjoyment. Brewer (2005) described that the greatest enjoyment in teaching comes from seeing students who have achieved success academically, and in seeing the students developing their personal characters and identities. Kuruseka (2003) reported that about 75% of teachers teaching English as a foreign language described that their enjoyment was contributed by working with children. In a study of the reasons why excellent technology teachers enjoy teaching, most of the teachers cited that working with children and seeing the impact of the teachers' contribution to society as the enjoyable aspects of teaching (Wright & Custer, 1998). The teachers believed that these two aspects of enjoyment were essential components for motivating teachers intrinsically (Day, Stobart, Sammons, & Kington, 2006). In addition to that, Wright and Custer (1998) reported that the majority of teachers considered learning new technologies as the most important aspect of enjoyment derived from teaching. Eick, (2002) reported that the desire to continue teaching is linked with enjoyment, the passion and love to interact with children and the belief that teachers are the ones that could help develop society in the future (Nieto, 2003). William (2003) revealed that excellent teachers were motivated to continue teaching because they were able to fulfil their personal accomplishment by seeing the students' successes.

Past research has associated motivation with satisfaction (Bidwell, 1955; Dinham & Scott, 1998). Dinham & Scott, (1998) cited a statement of Nadler and Lawler (1991) that motivation is stimulated by a particular behaviour and satisfaction is the product of that behaviour. On similar lines, Zembylas and Papanastasiou (2003) reported that the level of intrinsic motivation stimulated by working with children, seeing their progress and achievement, and making contribution to society are among the factors attributing to teachers' satisfaction, and maintaining a good level of motivation in the job. In their study, teachers proclaimed that teaching gave them an opportunity to experience new challenges and allowed them to explore, create and improvise the ways they teach. By having this kind of motivation, teachers are more satisfied with the work and this satisfaction will either maintain their motivation, or further motivate them to aim for a higher level of satisfaction. Thomas (1983) stated that satisfaction and motivation possibly move in a circle. This implied satisfaction tends to motivate teachers to aim for higher performance and achievement to fulfil their sense of accomplishment.

Anderson and Iwaniski (1984) reported that teachers need self-actualization because without it may lead to teacher burn-out; they suggested that teachers must be provided with opportunities to enhance self-actualization. Self-actualization is described as "the full use and exploitation of talents, capacities, potentialities, etc. Such people seem to be fulfilling themselves and to be doing the best that they are capable of doing" (Maslow, 1959; p 150). Anderson and Iwaniski (1984) cited Sergiovanni and Carver (1974) who reported that self-actualization is the need for achieving full potential, personal and professional success and reaching for peak satisfaction. Coble and Hounshell (1972) described Maslow's theory of self-actualization by stating that "people who are positively able to take self-action are primarily motivated by the need for self-actualization, thus according to them are able to

become better teachers and parents". This study will consider the definition by Coble and Hounshell (1972). Eick (2002) reported that science teachers whose qualification were science majors viewed teaching as a way to utilize and impart their knowledge and enhance their learning in science. This study also showed that teachers whose backgrounds were science majors were more motivated to enhance their talents and capacities. In another study on teachers' job satisfaction and motivation for teacher effectiveness, reaching one's potential and personal growth was ranked as the third most important factor that motivated teachers to teach (Ololube, 2006).

The above reported literature suggests that enjoyment, satisfaction and self actualisation are important factors associated with intrinsic motivation. Using these pieces of research as a guide, intrinsic factors for this study were classified to three categories namely enjoyment, satisfaction and self-actualization. There are many motivation studies reported from all parts of the world including South Africa (Bennell & Akyeampong, 2007); USA (Ingersoll & Perda, 2003), and Australia (Ingersoll, 2003). In Brunei, factors affecting teacher motivation have not been explored. As Bruneian culture and economy are different, the perceptions can be influenced by such factors, it is therefore of interest to examine to what extent are the science teachers in Brunei perceive intrinsic factors to be important in influencing their motivation to teach. It is also of interest to find how these perceptions are affected by the teachers' gender, marital status, nationality, experiences, level of grade taught and geographical location of teachers' workplace.

As motivated teachers are often associated with producing motivated students with high achievement (Atkinson, 2000), the study will provide useful information to educators on the variables that will inspire science teachers to accomplish their task effectively. In this respect, it is hoped that administrators and school leaders can use the findings to create learning environments that will be more effective in motivating teachers.

Aims

The aims of this study were to research on (i) science teachers' perceptions of the importance of intrinsic factors and (ii) how their perceptions of the importance of intrinsic factors are affected by independent variables such as gender, marital status, teaching experience, grade level taught and geographical location of workplace.

The study focus to answer the following questions:

1. How reliable and valid was the instrument for measuring the perceived importance of intrinsic factors in affecting science teachers' motivation to teach?
2. What intrinsic factors did science teachers perceive important for motivating them to teach?
3. Are the science teachers' perceptions of intrinsic motivation factors influenced by their gender, marital status, nationality, level of grade taught, teaching experiences and geographical location of work place?

Methodology

Research Design

This study used a survey technique that follows a "one-shot" case study design (Setiawan, 2020a; 2020b; 2017; Campbell & Stanley, 1966). The quantitative method was used to collect data on the teachers' motivation to teach and the associated factors affecting their

motivation to perform their job. Interview technique was used to collect qualitative data. The interviews were used to elicit more in-depth information about factors affecting science teachers' motivation to teach. The qualitative information obtained was used to triangulate the quantitative data obtained in this study (Setiawan & Mufassaroh, 2019).

Sample

A set of 430 questionnaires were distributed to 28 government secondary schools in all the four districts of Brunei: Brunei Muara, Tutong, Belait and Temburong. Only 351 secondary science teachers returned the questionnaires. The participation rate was about 82%. 109 male science teachers and 242 female science teachers participated in this study. The number of science teachers in each district who participated in this study was: 248 in Brunei- Muara, 50 in Belait, 40 in Tutong and 13 in Temburong. These numbers are in line with the number of schools as well as the demographic patterns in the four districts. When categorized based on nationality (Bruneian or expatriates), 335 of these teachers were Bruneian and 16 were expatriates. The number of science teachers teaching lower secondary level, upper secondary level and both levels (lower secondary level and upper secondary level) were 163, 141 and 47 respectively. The marital status of the teachers comprised of three groups: 196 teachers were married, 138 teachers were never married and 17 teachers were categorized as others. The teaching experiences of the sample was categorized into 5 groups: 79 teachers had teaching experience of 2 years and less, 148 teachers of 3-6 years, 55 teachers of 7-10 years, 24 teachers of 11-14 years and 45 teachers of 15 years and more.

Eighteen teachers (5%) from the sample were interviewed. All the teachers participated in the interviews were teaching in co-educational schools. The teachers interviewed were 3 males and 15 females; they all were Bruneian and represented all the four districts of Brunei. Out of 18 teachers interviewed, 12 teachers were never married and 6 teachers were married. The sample interviewed comprised of 8 teachers teaching only lower secondary level, 6 teachers teaching only the upper secondary level and 4 teachers teaching both (lower and upper secondary) levels. In terms of teaching experiences, 2 teachers have teaching experience of 2 years and less, 8 teachers have teaching experience of 3-6 years, 4 teachers have teaching experience of 7-10 years, 3 teachers having experience of 11-14 years and 1 teacher have teaching experience of 15 years and more.

Instrument

The instrument used in this study was a new instrument. The questionnaire used consisted of 2 parts: part 1- the science teachers' demographic information and part 2- covered intrinsic factors. In part 1, the teachers responded to close ended and open ended questions. The items included gender, marital status, and qualification, teaching experience, nationality, grade level taught and science subjects taught. In part 2, science teachers responded to the intrinsic factors they perceived as important in motivating them to teach science. This section consisted of 3 scales representing enjoyment, satisfaction and self-actualization intrinsic factors. Each scale in the intrinsic factor consisted of 9 items. Each item included a four point Likert response format: very important, important, somewhat important and least important.

A semi-structured interview technique was used in this study to collect the qualitative data. The interview questions were associated with factors covered in the questionnaire. Teachers' quantitative responses also guided the interview questions, especially where mean responses were low and high.

Table 1

Factor Loadings for Items in the 24 Intrinsic Items of the Instrument for Individual Science Teacher as the Unit of Analysis (n=351; #=indicators for deleted items)

Item	Enjoyment	Satisfaction	Self-actualization	h^2
Q1	0.60			0.40
Q2	0.75			0.63
Q3	0.59			0.48
Q4	0.58	0.43*		0.54
Q5	0.69			0.62
Q6	0.59	0.41*		0.54
Q8#	0.63			0.51
Q9	0.50		0.48	0.49
Q10		0.60		0.52
Q11		0.65		0.49
Q12		0.55		0.54
Q13		0.71		0.58
Q14		0.59		0.51
Q15		0.60		0.54
Q16		0.55	0.51*	0.58
Q17		0.71		0.69
Q18		0.70		0.67
Q21#			0.42	0.52
Q22		0.45*	0.61	0.64
Q23			0.59	0.50
Q24			0.77	0.64
Q25			0.71	0.62
Q26			0.75	0.66
Q27			0.62	0.56
Eigenvalues	1.40	10.22	1.63	
% Variance	16.72	20.49	18.04	55.25

Note: Cut-off point = 0.40, # = Deleted items due to lower loading in the parent factor.

Results and Discussions

This section is divided into three sections namely instrument's variables, teachers' perceptions of importance of intrinsic factors and effects on demographic variables on teachers perceptions.

Instrument's Variables

This section reports factor analysis, alpha reliability, discriminant validity and eta square coefficients for the data reported in this study.

Factor analysis. The items in three scales were analysed using factor analysis. Factor analysis was used to check the extent to which each item in the 3 scales contributed to the respective factor. Principal component analysis and the rotational method varimax were used to produce orthogonal factors which were unrelated or independent of one another. When the principal component analysis and varimax were performed for 27 items representing three scales covering the intrinsic variables, it successfully yielded 3 factors

which were orthogonal. However, factor loading for three items (7, 19, and 20) were low and represented more than one factor. These items were deleted. Therefore, under the present conditions, this instrument was reduced to 24 items that factorised into 3 factors representing 8, 9 and 7 items in enjoyment, satisfaction and self-actualization scales respectively. Table 1 shows the factor loadings for 24 items in three scales in the instrument covering intrinsic factors. For this analysis, factor loadings of less than 0.40 have been excluded. These 24 items in the intrinsic motivation instrument explained the 55.25% of the total variance. The percent variance explained in this study was comparable to the variance 52.7 % and 51.1% for seven and six factors reported by Fisher and Waldrup (1997) and Dhindsa, (2005) respectively.

Alpha reliability. The cronbach alpha value for the whole instrument was 0.94. The cronbach alpha values for the different scales ranged from 0.85 to 0.90. Literature has shown values in the range of 0.80 and above were the most internally reliable (Blaike, 2003; Bryman & Cramer, 1999). The reliability values for the overall instrument and the scales suggest that the instrument covering intrinsic variables was reliable.

Table 2

Reliability, Discriminant Validity, Mean and Standard Deviation Data for Each Scale in the Instrument (n=351)

	No of Items	Alpha reliability	Discriminant validity	η^2	Mean $\pm$ S.D
Enjoyment	8	0.85	0.35	0.13*	3.45 $\pm$ 0.44
Satisfaction	9	0.90	0.48	0.10	3.37 $\pm$ 0.49
Self-actualization	7	0.87	0.37	0.13*	3.21 $\pm$ 0.50

No=Number of item, SD=Standard deviation. * = $p < 0.05$.

Discriminant validity. The discriminant validity values for the scales ranged from 0.35 to 0.48 (Table 3). In this case, values are somewhat higher. This is because the intrinsic factors overlap to a larger extent. There were studies in the literature that has reported similar values. Huang (2001) reported discriminant validity coefficients (mean partial inter-scale correlations) which ranged from 0.24 to 0.53. These data suggest that the instrument used for this study, despite some overlap, had adequate discriminant validity. The readers should keep this data in mind when reading the results reported for this instrument.

Eta square, (η^2). Since there were variations between schools, therefore, it was decided to compute η^2 for schools to see if the instrument can pick up these differences. Analysis of variance (ANOVA) results in Table 2 indicated that science teachers' perceptions of the two intrinsic scales (enjoyment and self-actualization) varied significantly ($p \leq 0.05$) and for satisfaction non-significantly among schools ($p > 0.05$). The values of η^2 ranged from 0.10 to 0.13 with a mean of 0.12, suggesting that about 12% of the variance in the intrinsic factors scores can be accounted for by the science teachers' school membership. These data suggest the instrument successfully picked up the expected school based differences, which is a quality of reliable and valid instrument.

Teachers Perceptions of Importance of Intrinsic Factors

This section deals with quantitative and qualitative data on teachers' perceptions of intrinsic factors.

Quantitative data. The high scale mean value for enjoyment factor (3.45) suggested that teachers perceived enjoyment as the most important factor affecting their motivation to teach science. The results also suggested that the science teachers regarded satisfaction (3.37) and self-actualization (3.21) as important for motivating the science teachers to teach science. The comparable and low standard deviation values suggest that teachers were in close agreements in their responses.

Qualitative data. The teachers' interview revealed their views on the importance of each intrinsic factor towards motivation to teach science. Teachers' views on enjoyment, satisfaction and self-actualization factors are reported separately.

Enjoyment. Excerpts form teachers' selected interviews associated with enjoyment factor are reported below.

- Teacher B:* "It's very important to enjoy teaching, for example, if you don't like science at all and your background is in Mathematics and you are teaching science, your motivation to teach will be possibly less. Teachers must enjoy teaching the subject so that students are also motivated to learn".
- Teacher E:* "It's very important to enjoy teaching science because if you are not enjoying teaching your students will not be motivated and interested in learning science".
- Teacher R:* "Enjoyment is a very important factor because if you don't enjoy the subject, then the students won't be interested in what you are teaching".
- Teacher O:* "Enjoyment is very important for science teacher to teach otherwise without enjoyment you cannot teach very well--- you need to enjoy doing your work".
- Teacher I:* "Enjoyment is very important for motivating teachers because if you do not enjoy what you are doing, you are not going to give the best in your teaching. If you don't enjoy teaching the subject, you are not giving your full commitment in what you are doing in the class".
- Teacher H:* "The drive to teach comes within ourselves that means we need to enjoy teaching science. Enjoyment is very important; otherwise our lessons will be boring. If we enjoy teaching science that means we are giving/ doing our best in our teaching".
- Teacher G:* "Enjoyment is very important. Otherwise, the students will not likely to learn if we don't show enjoyment in teaching. However, if there is a lot of administrative work, we become tired. As a result, the enjoyment of teaching is affected"
- Teacher P:* "Surely enjoyment is important... The students themselves can affect your teaching, for example, I am teaching Form 1B (Grade 7B) and Form 1F (Grade 7F). The classes are high achieving and low achieving classes. Frankly speaking I enjoy teaching 1B because of the good responses that I get from the students. Low achieving classes can affect motivation and sometimes they take away your enjoyment in teaching especially when the students are too lazy to do their work"

All the teachers who were interviewed agreed that enjoyment is an important factor. However there were some differences in terms reasons emphasised for their perceived

importance of enjoyment. For example, the teachers B, E, and R agreed that the enjoyment in teaching was particularly important as it appears to affect students' interest and motivation to learn the subject. The teachers O, I and H have emphasised that the importance of enjoyment as a motivational factor for delivering their best services and commitment to teaching. These views are consistent with previous studies of Wild, Enzle and Hawkins as cited by Patrick, Hasley, & Kempler (2000) who reported that students' perceptions of the teachers' intrinsic motivations affected the students' desire to learn. The high scale item mean value of 3.45 for enjoyment obtained using the survey questionnaire is well supported by these qualitative data collected through interviews. Moreover, when considering the views of Teachers G and P, it is clear that teachers' enjoyment (intrinsic factor) is positively and negatively influenced by the quality of students and non-teaching administrative load respectively. These are extrinsic factors. The data support the views of (Renewal, 2001; Vroom, 1995) that extrinsic factors influence the intrinsic motivation of teachers.

Satisfaction. Excerpts from teachers' selected interviews associated with satisfaction factor are reported below

- Teacher A:* "Job satisfaction is very important in motivating teachers. When students get good results teachers will also improve their teaching in order to see that more students will achieve well. Of course, teachers feel happy with students' good performances and this will motivate them to improve their teaching skills, not only for high ability students but also for low ability students".
- Teacher F:* "For me, if the students gain distinction in science, I have done a good job. If the students are poor and they can achieve a pass, it's already good. If the students are average, and they get credits or distinction, this satisfies me in teaching science. Satisfaction is very important in motivating me to teach and to achieve better results in the future".
- Teacher E:* "I think satisfaction is very important. When we see students achieving good grades in the examinations we become satisfied and it will motivate us further. If there are fewer students gaining credits in the exam, you will try other methods to teach to improve students' performance".
- Teacher I:* "Satisfaction is very important for influencing teachers' motivation to teach because if we are not satisfied, how can we become motivated further?. Satisfaction also allows us to reflect on our teaching to see whether the methods we used are successful or not. If we are not satisfied, we can modify or change our methods of teaching".
- Teacher Q* "If the students work hard, if they cooperate well, whatever you ask them to do and they do their work, then I think satisfaction of teachers will be high".

When asked about the importance of the satisfaction factor in motivating the science teachers to teach, all teachers agreed that satisfaction is an important factor. Their satisfaction, however, was linked to students' improved performances in the examination that encouraged them to improve their teaching practices to achieve further improvements in their students' achievements. In these excerpts, teachers stated that their satisfaction from

students' achievement tends to motivate them to improve their classroom practices including (teaching methods) that should improve students' achievement in the subject; a cyclic process. One interpretation of the above excerpts is that satisfaction and motivation possibly move in a circle as reported by Thomas (1983). It is impossible to separate the satisfaction and motivation as they are interrelated to each other (Dinham & Scott, 1998). Kusereka (2003) pointed out that high satisfaction indicates high motivation. These interview extracts indicate that the lack of feeling of satisfaction allows teachers to reflect, modify and change their teaching approaches, which is inline with comments by Zembylas and Papanastasiou (2003) who stated that teaching profession provides opportunity for teachers to create and improvise the ways they teach. In general, the qualitative data is inline with the quantitative data that is the scale item mean value of 3.37 out of 4. When considering the view of Teacher Q it is clear that teacher's satisfaction (intrinsic factor) is positively influenced by the quality of students, hard working and cooperative nature of students; which is an extrinsic factors. The data support the views of (Renewal, 2001; Vroom, 1995) that extrinsic factors influence the intrinsic motivation of teachers.

Self-actualization. Several teachers said that self-actualization was also a very important factor in motivating them to teach science. These teachers described the importance of self-actualization in terms of the perceived need for their professional successes, particularly in improving their skills. These are shown in the following excerpts:

- Teacher C:* "Self-actualization factor is very important for motivating teachers. For example, teaching mole in chemistry is not easy. Teacher can find ways to teach mole by researching through the internet. In a way, this helps the science teachers to develop certain skills in teaching difficult topics".
- Teacher E:* "Self-actualization is also very important because you can improve yourself from time to time and you are always up to date. The knowledge in science also keeps on changing, for example, now you cannot state concentration gradient anymore when teaching but must use "moving from high concentration to low concentration". Self actualization is very important because we have to make ourselves fully prepared and equipped in teaching to give our best to the students".
- Teacher H:* "Self actualization is very important in terms of improving our methods of teaching so that students can understand your lesson better".
- Teacher J* "Self-actualization is important..... Teaching is a challenging job but I am also doing other administrative duties which I think are more challenging than teaching. I am the Senior Master, Head Teacher for Discipline, I am involved with the Forestry club and so on. Involvement in all these administrative duties though can polish your abilities but too much of these non-teaching workloads somehow affect teaching".

The majority of the science teachers during the interviews considered self-actualization in the range of important and very important. It means that there were some teachers who were outside this range. This data is in line with the quantitative data that recorded a mean value of 3.21 out of 4. This value is lower than that of 3.45 for enjoyment and 3.37 for satisfaction. These data are inline with the finding that teaching enables science teachers whose qualification were science majors to utilise their knowledge and improve their learning in science (Eick, 2002). Moreover, the importance of self-actualization was

addressed by Anderson and Iwaniski (1984) who reported that the lack of self-actualization may lead to teacher burnout.

Moreover, the views of Teacher J highlight that although additional non-teaching responsibilities (extrinsic factor) improve teachers for taking over career responsibilities (an aspect if self-actualization, the intrinsic factor), however overburdening with non-teaching responsibilities have negative influence on the intrinsic motivation to teach science. These data support the views of (Renewal, 2001; Vroom, 1995) that extrinsic factors influence the intrinsic motivation of teachers.

Table 3

Scale Item Mean Values, Standard Deviation, Significance Levels and Effect Size Data for Gender of the Subjects on Three Intrinsic Factors

Scale	No	Scale Mean		<i>t</i> -value	<i>p</i> -value	ES
		Male (n=109) Mean $\pm$ SD	Female (n=242) Mean $\pm$ SD			
Enjoyment	8	3.32 $\pm$ 0.45	3.51 $\pm$ 0.51	0.27	0.00*	0.42
Satisfaction	9	3.26 $\pm$ 0.51	3.42 $\pm$ 0.42	0.27	0.01*	0.33
Self-actualization	7	3.17 $\pm$ 0.52	3.24 $\pm$ 0.50	2.15	0.22	0.10

No=Number of item; n=Number of subjects; SD=Standard deviation; ES=Effect size; $p^* \leq 0.05$

Effects of Demographic Variables on Teachers Perceptions.

This section deals with the influence of respondents' gender, marital status and grade level on their perception of importance the respondents

Gender. The scale item mean, standard deviation and independent t-test analysis data for male and female teachers for the three factors representing intrinsic variables are reported in Table 3. Analysis of these data using independent t-test revealed *p*-value of 0.22 for self-actualization, 0.00 for enjoyment and 0.01 for satisfaction. A *p*-value (0.22) greater than 0.05 obtained for self-actualization suggested that the mean values for male and female teachers were statistically non-significantly different. These data suggest that the male and female teachers' perceptions on the importance of the self-actualization factor towards their motivation to teach were not influenced by their gender. The significant *p*-values for enjoyment and satisfaction factor suggested that the mean values for the female teachers were statistically significantly higher than for the male teachers. The significant differences with low to medium level effect size values, (0.42, and 0.33) suggested these differences were of some educational importance. This implies that the female teachers regarded enjoyment and satisfaction as more important intrinsic factors affecting their motivation to teach science than the male teachers. This finding is consistent with previously reported research which stated that (a) females teachers were found to be more satisfied with their work than the males (Ma & MacMillan, 1999; Poppleton & Riseborough, 1991) and (b) females tend to enjoy working with students more than the male teachers (Eick, 2002). However, the finding is in contrast with Crossman and Harris's (2006) research findings that stated males were slightly more satisfied than their counterparts.

Further analysis of data revealed that there were no significant gender differences in unmarried respondents' perceptions of the three intrinsic factors, however, there were significant differences in perceptions married males and females (in favour of females) of enjoyment ($p=0.005$; $ES=0.45$) and satisfaction ($p=0.033$; $ES=0.34$) factors. These results suggest that gender differences reported in this study were mainly contributed by the married respondents. This is inline with cultural values of the society where female contribute more towards bringing up children, hence they scored on these factors higher than the males.

Considering the overall data for three intrinsic factors, gender influence was observed on two of the three factors. Based on this information, it was concluded that married male and female teachers perceived the importance of intrinsic teacher motivation variables differently.

Table 4

Scale Item Mean Values, Significance Levels and Effect Size Values of the Subjects with Different Teaching Levels on the Three Intrinsic Factors

Scale	No	Scale Mean					Scheffe Post-hoc		
		LS	US	LS & US	F value	p value	LS	LS	US
		Mean	Mean	Mean			vs	vs	vs
		(SD) n=163	(SD) n=141	(SD) n=47			US (ES)	LS & US (ES)	LS& US (ES)
Enjoyment	8	3.50 (0.43)	3.48 (0.42)	3.23 (0.47)	7.12	0.00*	0.92	0.00* (0.59)	0.00* (0.55)
Satisfaction	9	3.38 (0.47)	3.40 (0.49)	3.24 (0.55)	2.04	0.13	0.96	0.20	0.15
Self-actualization	7	3.26 (0.48)	3.19 (0.52)	3.11 (0.55)	1.85	0.15	0.51	0.19	0.61

No=Number of items, SD=Standard deviation, ES=Effect size, LS=Lower secondary level, US=Upper secondary level. * $p<0.05$

Grade level taught. The scale item mean values, and ANOVA results of the scales for 3 groups of teachers classified based on grade level taught (Lower secondary, upper secondary, or both) are reported in Table 4. The ANOVA analysis of the data for enjoyment scale revealed statistically significant p -value of 0.00 for the comparisons of the perceptions of 3 groups of science teachers. This value suggests that at least 1 out of 3 possible comparisons was likely to be statistically significantly different. The post-hoc analysis of the data revealed that 2 out of 3 comparisons were statistically significant. The post-hoc results suggested that for enjoyment scale, the mean value of 3.50 for those science teachers who taught lower secondary level was statistically significantly higher than those who taught both lower and upper secondary levels (3.23). The mean enjoyment value of 3.48 for the science teachers who taught at upper secondary level was also statistically significantly higher than that of the teachers teaching both lower secondary and upper secondary levels (3.23). The moderate effect size values of 0.59 and 0.55 for these comparisons indicated that these differences were of educational importance. These results suggest that teachers teaching only at one level (lower secondary or upper secondary level) perceived enjoyment variables as more important to their teaching motivation than those teachers who taught at

both lower and upper secondary levels. A possible explanation could be because teaching both levels (lower secondary and upper secondary level) demanded more preparation than teaching only one level. National Education Association (2003) reported that teachers considered workload and extra responsibilities as one of the factors that could affect their teaching, thus, this probably could be the reason why teachers teaching both levels perceived enjoyment factor less important than those teaching only one level. However, the mean values for satisfaction and self-actualization scales for all the three possible comparisons between three groups of respondents were statistically non-significantly different.

Table 5

Scale Item Mean Values, Standard Deviation, Significance Levels and Effect Size Data for Marital Status of the Subjects on Three Intrinsic Factors

Scale	No	Scale Mean			F value	p value
		NM (n=138) Mean±SD	Ma (n=196) Mean±SD	Oth (n=17) Mean±SD		
Enjoyment	8	3.40 ± 0.42	3.48 ± 0.45	3.43±0.49	1.36	0.26
Satisfaction	9	3.30 ± 0.45	3.42 ± 0.50	3.30 ± 0.65	2.62	0.74
Self-actualization	7	3.18 ±0.47	3.23 ± 0.51	3.27 ± 0.70	0.58	0.56

No=Number of item, n=Number of subjects, NM = Never married, Ma=Married, Oth=Others, SD=Standard deviation.

Marital status. The scale item mean values, and ANOVA results for three scales for the 3 groups of science teachers classified on the bases of marital status are reported in Table 5. Since the *p*-values for the three groups on three scales were greater than 0.05, therefore, post-hoc analysis was not necessary. The *p*-values greater than 0.05, suggested that the mean values for 3 groups of teachers for enjoyment, satisfaction and self-actualization were statistically non-significantly different. These results suggest that teachers grouped based on their marital status did not perceive the importance of intrinsic variables differently in motivating them to teach.

The overall summary of the results suggest that the questionnaire and interviews indicated that science teachers rated the intrinsic variables from important to very important. None of the teachers considered the intrinsic variables as moderately important or least important. Also during interviews these finding was revealed. Therefore, the qualitative findings complement the high mean obtained in the quantitative data. The teachers' perceptions on the importance the intrinsic variables to influence their motivation was affected by gender and grade level taught but not marital status, grade levels taught and geographical location of their workplace.

Conclusions, Implications and Future Research Directions

Under this section, responses to research questions, implications of the findings to teaching and learning and future research directions are reported.

Conclusions: Response to Research Questions

These section deals with Responses to three research questions reported under objective.

1. How reliable and valid was the instrument for measuring the intrinsic factors science teachers perceived as affecting their motivation to teach?

The instrumental variables data reported under the results and discussion section on the factor analysis, alpha reliability, discriminant validity and η^2 coefficients suggested that the instrument covering intrinsic factors was reliable and valid for use in this study.

2. What intrinsic factors do science teachers perceive important for motivating them to teach?

The high scale mean value of 3.45, 3.37 and 3.21 for enjoyment, satisfaction and self-actualization factor respectively suggested that teachers perceived these factors as important in affecting their motivation to teach science. The interviews (qualitative data) indicated that science teachers rated the intrinsic variables from important to very important. None of the teachers considered the intrinsic variables as moderately important or least important. Therefore the quantitative and qualitative findings complemented each other.

3. Were the science teachers' perceptions of intrinsic motivational factors influenced by their gender, marital status, and the grade level taught by teachers?

The respondents' perceptions on the importance the intrinsic variables that influence their motivation to teach science were influenced by gender and grade level taught but not by marital status, and geographical location of their workplace.

Implications

The present study indicated that teachers' motivation to teach science is influenced by intrinsic factors. For example, teachers perceived the enjoyment factor as the most important intrinsic factor in motivating them to teach. It is therefore important for creating environment to sustain enjoyment in doing their work. It is also important to ensure that their motivation to teach is sustained and maintained. The information on the importance of these factors as revealed by this study implies that education stakeholders should work collaboratively to find solutions that sustain and maintain teachers' motivation. The findings also provide a reference point for educators of the requirements that are needed to motivate the science teachers.

The data from the study also revealed that teachers teaching at only lower or upper secondary level perceived enjoyment as more important in motivating them to teach science, compared to the teachers teaching at both levels. This finding implies that the school administrators need to take this factor into consideration when delegating teachers' workload. Enjoyment of teaching may be affected because teaching at both levels requires more time for teachers to prepare lessons.

Science teachers in Brunei perceived the importance of intrinsic factors towards motivation to teach and also highlighted a link between extrinsic and intrinsic factors. As reported by Ozcan (1996), the presence of intrinsic motivation needs to be sustained and maintained by the existence of extrinsic factors. Therefore, although science teachers

considered enjoyment as an important factor, it is vital to create an external environment for sustaining, maintaining and improving teachers' motivation.

The student quality was another very important factor perceived by teachers to affect motivation to teach science. Teachers are often concerned with the lack of students quality in which they found that students are lazy, unmotivated and cause behavioural problems. With regard to this, educators may argue that a motivated teacher should build rapport with the students in order to attract the students' interest in what they are learning. However, the teachers may lack diagnostic and intervention strategies that prove effective for motivating students. This means that, at times when students' poor behaviour appears to be on the increase, educational planners need to emphasize the psychological aspects in areas of motivation in the pre-service education training in order to effectively prepare teachers to cope with the lack of student quality in behaviour. Special professional training also needs to be initiated for the present science teachers to learn effective techniques in dealing with students' difficult behaviour. Moreover, more research in dealing with teacher intrinsic motivation is recommended.

Future Research Directions

The study only involved science teachers teaching in all government secondary schools. This research can be replicated with science teachers in primary government schools and in private schools. Moreover, the study can be extended to other subjects. This would provide a more comprehensive perspective on the existing motivation of the science teachers and the factors affecting their motivation Brunei.

In this study questionnaires and interviews are used to collect data. The use of observations and documental analyses techniques is recommended to improve the triangulation of the results. It may be particularly useful to find out the links between teachers' motivation and students' motivation to learn using observations.

The study did not report the extrinsic factors. Since research reports a link between intrinsic and extrinsic factors, it is therefore important to study to what extent teachers perceive the importance of extrinsic factors on teachers' motivation to teach science. Further study on this may provide educators with a clearer scenario on the working conditions and other factors under which teachers work. This shall provide educational stakeholders with useful information for providing interventions. Future research could also be conducted to determine the influence of teachers' personal characteristics on their motivation to teach.

In conclusion, this study provides some basis for finding the possible factors for enhancing teachers' motivation. It also serves as a reference for further research studies on teachers' motivation in the context of Brunei.

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