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Learning Styles of the Secondary Students in ARMM in Relation to their Performance in the Biology- Component of the National Achievement Test: Basis for Culture – Sensitive Modular Instruction

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Abstract: This study is a descriptive-correlational and developmental, dealing with the learning styles of 661 secondary biology students, who comprised of four cultural minority groups, namely: a) Maguindanaon, b) Meranao and c) Tausog; and d.) Mixed-culture group consisted of Christians and other non-Muslim denominations of the Autonomous Region in Muslim Mindanao (ARMM), and its relationship of their performance in the biology component of the National Achievement Test (NAT). The learning styles of the respondents were measured using the Index of Learning Style by Felder and Solomon (1995) and Learning style Inventory by Kolb. The collected data of these two instruments were analysed with the use of frequency, weighted mean, Pearson-Coefficient correlation and ANOVA. Results revealed that there is no significant relationship between the performances of the respondents in biology component of the National Achievement Test with their Felder and Solomon learning style in the case of active/ reflective and visual/ verbal learning style, thus null hypothesis was accepted. On the other hand, in the case of sensing/ intuitive and sequential/ global learning style the null hypothesis was rejected. In Kolb's learning styles, results show no significant relationship between the performances of the respondents in biology-component of the National Achievement Test with their Kolb's learning styles. From the results of the study, the researcher designed an intervention program through modular instruction anchored to each culture in the respective participants such as the Maguinadanon, Meranao, Tausog, and the mixed – culture group. The culture based module designed by the researcher is the intervention to be used for the continuation of the study.

Keywords: learning style, culture-based module, biology performance

Introduction

The Philippine nation is composed of sixteen (16) different political regions, including the National Capital Region (NCR), Cordillera Autonomous Region (CAR), Autonomous Region in Muslim Mindanao (ARMM) and CARAGA Region. This fact implies diversity and variety of life patterns, traditions,

behaviors and values. As Pilispis (2007) states, “differences in geographical characteristics, like climate, topography, social conditions and natural resources account for social and cultural differences.” People coming from varying climates and topography are expected to exhibit differences in character traits. Moreover, different mentalities and biases of some groups are rooted on their respective inherited cultural values. Palispis added that cultural variations give rise to ethnocentrism which means that is culture differs, it culture defines reality. They are different because they tend to be conditioned by factors such as the natural resources within the environment, historical antecedents, human ingenuity, varying cultural integration within the society, and relativity of cultural standards within society.

Globally, the low performance of the Philippines in the Second International Science Study (SISS) and Third International Mathematics and Science Study (TIMSS) (Human Resource Council, 2000) alarmed the Department of Education (DepEd) enough to revitalize the basic education curriculum (RBEC) for secondary education in the year 2002. Simultaneously, the Commission on Higher Education (CHED) revised the curriculum of the Bachelor of Elementary Education (BEEd) and Bachelor of Secondary Education (BSEd) under CHED Memorandum Order 30, Series of 2006, so that Filipino student performance in Science, Mathematics and English would improve. It also hoped to provide quality education for the students, making them ready, capable, and competent, as well as effective and efficient citizens of society.

Moreover, the Department of Education (DepEd) and National Examination and Testing Research Center (NETRC, 2004) gave the following tests: National Achievement Test (NAT), Regional Achievement Test (RAT), and Division Achievement Test (DAT) to evaluate the status of the teaching-learning process of the elementary and secondary levels of education. According to the NETRC Report in 2004, 2005 and 2006, the ARMM ranks third from the bottom which implied a deterioration of education in the region. In 2008, eventually, there was a significant improvement in the science subject area. However, in the year 2009 and 2010, there was again a remarkable decrease in the subject area noted. Lapus (2009) states that all possible interventions considered relevant and appropriate had been made on the educational system in the ARMM towards improving the performance of the students in the subject areas of Mathematics, Science and English, but it seems that result had not shown any significant improvement. As Smith (2000) states, people differ in how they go about certain activities associated with learning. Pelarjangan (2001) adds that each learner has his own strength and unique intelligence and, where possible, individual differences should be taken into account in the teaching process. In addition, Keefe and Ferrell (1990) state that learning problems are frequently not related to the difficulty of the subject matter, but rather to the type and level of the cognitive process required to learn the material. Guild and Garger (1985) support the idea that effective educational decision and practices must be derived from an understanding of the ways that individuals learn. Zulueta (2006) also supports

the idea that individual and group differences must be considered as the teacher plans her lessons and then teaches it.

The researcher has investigated the students' learning style, to explore its contribution and possibility for effective intervention in the teaching-learning processes for secondary biology subject. In addition, this investigation is conducted primarily within the framework of students' learning style, particularly among Maguindanaon, Meranao, Tausog and mixed-culture groups among the secondary biology students in the ARMM and examines its relationship to their performance in biology-component of the NAT. As Cassidy (2004) claims individuals learning style preferences affect their performance and achievement. In addition, Felder and Spurlin (2005) state that it is imperative for a teacher to examine the variations of their students' learning style, because the information about learner's preferences can help the teachers become more sensitive to the differences that students bring to the classroom. They add that adjustment can then be made to accommodate the students varied needs. As such, the concept of learning style would challenge teachers to rethink of their methods to improve students' academic achievements.

Research Methodology

This study was conducted in selected national high schools of the Department of Education-Autonomous Region in Muslim Mindanao (DepED-ARMM) using a combined quantitative and qualitative research design. The respondents of this study were the second year biology students of four cultural groups in ARMM. Table 1 shows the distribution of respondents in each selected tribe.

Table 1: Distribution of respondents

<i>Name of school</i>	<i>Total Number of 2nd yr students</i>	<i>Maguindanaon</i>	<i>Meranao</i>	<i>Tausog</i>	<i>Mixed-Culture</i>	<i>Total</i>
School A	375	131	18	15	30	194
School B	401	7	153	13	28	201
School C	796	0	0	217	49	266
Total	1572	138	171	245	107	661

The research instruments in the data gathering were; a) Index Learning Style (ILS). The ILS is a 44-question instrument designed to assess preferences on four dimensions: active/reflective, sensing/intuitive, visual/verbal and sequential/global of learning style model formulated by Richard M. Felder and Linda K. Silverman (1991). This instrument was developed by Richard M. Felder and Barbara A. Solomon of North Carolina State University. It is available at no cost for non-commercial purposes by educators who wish to use it for teaching, advising or research. b) Learning Style Inventory (LSI). This LSI was adapted from the Kolb learning abilities model (1985). It is composed of fifteen (15) questions, each of which asks the students to rank the given sentence that correspond to the four learning characteristics of the respondents, which are

concrete experience, abstract conceptualization, reflective observation and active experimentation. This instrument was used by the researcher to supplement the Index of Learning Style of the respondents. It is a forced-choice method by which to measure an individual learning orientation toward the mentioned learning styles, c) NAT Biology Score.

Results and Discussion

There were four dimensions of learning styles in the Felder and Solomon learning style as follows: strongly active, moderately active, mildly active, mildly reflective, moderately reflective and strongly reflective; strongly sensing, moderately sensing, mildly sensing, mildly intuitive, moderately intuitive and strongly intuitive; strongly visual, moderately visual, mildly visual, mildly verbal, moderately verbal and strongly verbal; strongly sequential, moderately sequential, mildly sequential, mildly global, moderately global and strongly global as suggested by Felder and Spurlin (2005).

a. Learning Style

Table 2
Respondents' active/reflective learning style

<i>Respondents' Cultural group</i>	<i>N</i>	<i>Strongly reflective</i> %	<i>Moderately reflective</i> %	<i>Mildly reflective</i> %	<i>Strongly active</i> %	<i>Moderately active</i> %	<i>Mildly active</i> %
Maguindanaon	133	0.75	6.01	12.8	19.55	15.79	14.2
Meranao	170	0	2.35	3.53	32.94	18.82	8.23
Tausog	231	0	0.86	18.6	25.11	16.45	17.3
Mixed-Culture	107	0	2.80	13.1	11.21	5.61	0

Table 2 shows that the Maguindanaon and Meranao had similar trends in the active / reflective learning style, which is dominated by "strongly active" followed by "moderately active", "mildly active", "mildly reflective", "moderately reflective" then "strongly reflective". Unlike Tausog, and Mixed-culture, the trends of Maguindanaon and Meranao learning style were "strongly active" learning style. Active / Reflective learning style is a two-way mode of processing information by the learner. Active processing information is processing of information that views the learner as acting out the meaning of the information by demonstrating, illustrating or trying it out. Reflective learning style is processing of information that shows the learner as analyzing and manipulating the information through his own mind and feelings (Felder & Henriques, 1995). This response may exhibit the philosophy of John Dewey, as cited by Zulueta (2006) that "we learn by doing". Sarasin (1998) further adds that active learners learn and often rely on physical interaction in order to

master a concept. Moreover, maybe these respondents were adept at administration and team-oriented project work than doing individual research and design (Silverman, 2003).

On the other hand, many of the Mixed-culture respondents group favor mildly reflective processing of information over strongly and moderately reflective; as well as strongly, moderately and mildly active processing of information. This would mean that majority of them process information by gently analyzing and manipulating the meaning of the subject matter in their own mind and feelings. However, there were also some of them who favoured the strongly active learning style and process information as the minority respondents have done. The results would disclose that respondents favored the strongly and moderately active learning style, which would imply that they were active learners. They could understand new information by doing something with it, like doing group work, in which they learned best by applying them as guided through the active teaching styles. They learned best by way of the active teaching style, because of their being active learners. Active or laboratory method of teaching utilizes raw data or material things to produce better understanding of the subject matter or lesson and this also brings reality better to the learner (Calderon, 1998). Active learners give less analysis of the information presented to them while a reflective learner focuses more on forming images on the presented information to them. This keeps their information for a longer period of time which they can also integrate it through rehearsal, elaboration and organization with information that is already known (Zulueta, 2006).

The quantitative results affirmed by the findings at the interview to the randomly chosen respondents. The following is a portion of their responses to the question, *"What is your learning style?"* followed by sub-question *"How did you go about learning?"* Their responses showed that most of the interviewed respondents revealed a characteristic of the active learning style rather than the reflective learning style; Maguindanaon: *"I want all my family and relatives as listening to me."* She added that *"such that they can comment on my mispronunciation and I can ask them other ideas which make me understand more clearly about what I'm studying;"* Mixed Culture 3 responded that *"I'm studying with my friends and enjoy the moment;"* Another question asked her was *"why are you enjoying it?"* She replied *"Because we can share how do we understand the lesson;"* *"Itinatanong ko sa Tatay ko o sa mga kapatid ko ang hindi ko maintindihan."* This is in Filipino language which means *"I asked my father or my sisters and brothers on those matters that I cannot understand"*. Meranao *"Pesaboten aken so topic igira a kiyatenpengan aken go bo raken d dindiskasen."* This is in Meranao language which means *"I understand the topic when I tried it first before it will be discussed to me"*. *"Na igira nan d aken zaboten na ipegiza aken ko matao ron ago katawan yan na igira di niyan katawan na pag ilayn aken sa libro, diksyonaryo o di na sa Encarta."* This respondent expressed in Meranao language that *"If there is something I cannot understand, I asked the person who I think knew it, if he does not know, I looked it in a book, in the dictionary or in the Encarta."* Tausog *"Sinusuri ko muna ang problema*

bago pag isipan ang solusyon." This means "I investigate first the problem before thinking of the solution."

The most common form of learning is trial-and-error learning and learning by selecting and connecting. Palispis (2007) also supports the idea that when individuals are in the presence of others, they become aroused or motivated to perform some kinds of physical and social skills at higher level of excellence than when they would otherwise do alone, Palispis calls it social facilitation. He adds that group pressure exerts a powerful influence on the member's opinion. People tend to be willing to voice the same questions as others, even though they differ privately. He also added that group discussion plays an important role in shaping one's attitude and behavior. This process of attitudinal change is more easily accomplished in the group context than individually. This is also supported by Piaget's theory on thinking or cognitive development stages. According to Piaget, through interaction with their environment, particularly the people around him, children acquire new ways of thinking and new schemes.

Corollary to the interview with the biology teachers as respondents, the following excerpts of their responses to the question "What are the learning styles of your students you have observed during your class?" "Did you give an assignment to be answered by groups"? Some statement of the teachers is as follows: "Yes, but my interest is in their answer, not how they answered it." He looked at the checklist in his hand and thought for a while and said, "*baka makatulong ito sa gusto mong information, one time, nagbigay ako ng group assignment nong isara ko ang door paglabas ko narinig ko yong group of girls na ang isa kanila nagsasabing hatiin natin ito sa pag answer saka natin pag usapan before natin e pass.*" This means "May be this will help with the information you want. One time, I gave a group assignment, when I was about to close the door on the way out, I overheard from a group of girls that one of them said, we will divide this in answering and discuss about it before we will pass".

Silberman (1996) supports this finding in her statement about active learning as fast-paced, fun, supportive and personally engaging. She adds that to learn something these learners help to hear it, see it, ask questions about it, and discuss it with others. This may also infer that the active learning style is exhibited in the class of the interviewed teacher. Tanner and Allen (2004) adds that the use of both pedagogical strategies that structure student-student interaction during classes will vary instruction and allow for experiences that are optimal at different times to both reflective and active learners.

Table 3 shows that both the Maguindanaon and the Meranao had similar trends in the sensing/ intuitive learning style, which was dominated by "moderately intuitive" followed by "strongly intuitive", "mildly intuitive" then "mildly sensing". Among Tausog students, the trend was that "mildly intuitive" and "moderately intuitive" had equal percentage of students favoring it, followed by "mildly sensing" then "strongly sensing". On the other hand, for the Mixed-culture, the trend is dominated by "moderately intuitive" followed by "strongly intuitive", "mildly sensing" then "mildly intuitive". Sensing involves observing

and gathering data through the senses; intuition involves indirect perception by way of the subconscious--- accessing memory, speculating imagining (Felder and Henriques , 1995). Meanwhile the sensing/ intuitive learning style is a way of taking in information, in which the learner tends to perceive the subject matter.

Table 3
Respondent's sensing/intuitive learning style

<i>Respondents' Cultural group</i>	<i>N</i>	<i>Strongly sensing</i>	<i>Moderately Sensing</i>	<i>Mildly sensin g</i>	<i>Strongly intuitive</i>	<i>Moderately intuitive</i>	<i>Mildly intuitive</i>
		<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>
Maguindanaon	133	0.75	0	9.02	20.3	21.8	9.02
Meranao	170	0	1.75	5.29	21.18	30.00	11.78
Tausog	231	0.43	3.46	17.75	13.42	19.91	19.91
Mixed-culture	107	0	0	4.67	12.13	14.0	2.85

The results shown above would mean that their learning strategy in taking information was more inclined to meditation, which they had used instant memory or imagination as in giving them only initial information about principles or theory, as for example, the cell theory. Moreover, the respondents favoring moderate and strong intuitive learning results would mean that majority of them were intuitive learners. They preferred discovering new relationships and possibilities; they were comfortable with abstractions and mathematical calculations. They tended to work quickly and dislike routine tasks and memorization. However, they may at times fall into mistakes in calculations or hands-on work and as a result miss the important details of the lesson (Felder, 1995). This finding is cognizant of Piaget's claims that intuitive thinking was broader and was processed more leisurely. He added that it explores an extensive set of features, not just the essentials, drawing analogies and visual imagery, making connections with episodic as well as semantic aspect of memory. Benjafield (2007) mentioned that people interpret information that is given to them by making inferences and then remembering the inferences as a part of original information. In addition, existentialist epistemology supports this finding in their claims that the "individual is responsible for his own knowledge"; and it adds that knowledge is intuitive (Zulueta & Maglaya, 2007).

To dovetail the data obtained in the above quantitative results, qualitative data gathering was made through interviews and observation. The interview showed that there were many respondents with the characteristics that employ the intuitive learning style rather than the sensing learning style when they were asked "What is your learning style?" with the sub-question, "How did you go about learning?" The following excerpts are quoted from their responses: Maguindanaon "Sometimes I will read and re-read and memorize important events".

Researcher asked another question “Why do you repeat what you read of important events”? She replied again, “Repeating reading makes me understand the lesson.” Meranao said “I study hard and memorized important details in the lesson”; “Gusto kung alamin saan naggaling ang mga sagot” This means “I like to investigate how the answer was derived. Tausog said “Pag may nakita po akong litrato na koniktado sa aming pinag-aaralan sa school na binabasa ko” This means “I read that describe a picture that has a relation to our lesson in the school”. “I analyse first my assignment before answering them.

These characteristics were involved with the learner to discover the possibilities and linking relationship of ideas to the subject matter. Jacoby (1998), Jacoby and Kelly (1992), and Toth (2000) agree that studying in fragmented words is another way of knowing in the unconscious the influences of memory. Leaving the difficult parts to understand the topic and proceeding to next topic is a characteristic of the intuitive learning style, which the learner exhibits by ignoring the complexity of his task. This is supported by Zulueta (2006) in his claim of procedural memory as characterized the precisions of skill memory, also supported by the theory of Berkeley as cited by Zulueta and Maglaya (2004), which holds that the mind is active and is the agent of ideas, which are passive effects of mental activity.

Table 4
Respondent’s Visual/Verbal Learning style

<i>Respondents’ Cultural group</i>	<i>N</i>	<i>Strongly visual</i>	<i>Moderately visual</i>	<i>Mildly visual</i>	<i>Strongly verbal</i>	<i>Moderately verbal</i>	<i>Mildly verbal</i>
		<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>
Maguindanaon	133	0.75	0.75	6.01	15.8	18.04	3.0
Meranao	170	0	4.12	8.23	16.47	11.76	14.12
Tausog	231	0	1.18		21.21	17.32	19.19
Mixed-culture	107	0	0	3.74	9.34	10.28	2.80

The results shown in Table 4 indicated that both minorities and mixed-culture respondents received or understood the biology subject matter by powerful oral or written explaining or elaborating rather than in pictures or diagram presentation as shown in Table 4. Nelson (2003) supports the claim that learners who prefer the auditory style learn through hearing or listening. Listening receives the aural stimuli or the oral and visual stimuli presented by the speaker. Second, the listener focuses on selected stimuli, while ignoring other distracting stimuli. Felder and Henriques (1995) explain visual and verbal learning style as the ways people receive sensory information. Altman (2001) claimed that people remember the meaning of what they hear. Likewise, Johnson et al. (1996) add that an event described in words using the verbal system can be imagined using non-verbal system. Imagining is a characteristic of mental digestion of the presented information. As Sims and Sims (1995) suggest visual and verbal teaching styles must be presented simultaneously for them to be more

effectively learned. Perhaps this is the reason for their preference in learning style that a group with greater number in the moderate verbal learning style change, with a lesser number in to mild visual learning style; and groups with greater numbers in the mild visual learning alter, with a lesser number in to moderate verbal learning style. In addition to this variation of number in the learning style it may be emphasized that the respondents were good learners and were capable of processing information presented, either visually or verbally.

Table 5 shows that there were many Maguindanaon who prefer the “mildly, moderately and strongly global learning style; majority of the Meranao preferred strongly global learning style, followed by mildly global learning style, moderately global learning styles, mildly sequential then strongly sequential. Majority also of the Tausog preferred strongly global followed by moderately global learning style, mildly sequential learning style, mildly global learning style and then moderately global learning style.

Table 5
Respondents’ Sequential/ Global Learning Style

Respondents’ cultural group	N	Strongly sequential	Moderately sequential	Mildly sequential	Strongly global	Moderately global	Mildly global
		%	%	%	%	%	%
Maguindanaon	133	0.75	2.25	11.27	17.29	21.056	27.82
Meranao	170	3.53	7.06	7.65	30.0	12.35	13.53
Tausog	231	0	0.87	12.99	22.94	20.35	12.12
Mixed-culture	107	0	0.94	9.35	8.41	13.08	12.15

The results presented above would suggest that most of the respondents fall on global learning style or were global learners. They preferred to organize information more holistically and in a seemingly random manner without seeing connections. They often appeared scattered and disorganized in their thinking, yet they often arrived at a creative or correct end product (Felder, 1996). The findings of this study is supported by Entwistle (1987) who said that holistic or global learners are involved a preference o set the task in the broadest possible perspective and to use visual imagery and personal experience to build up understanding. In addition, Dandapani (2007) cites on the principle of perception known as the Law of Pragnanz, which “tends to perceive a stimulus as a good form. According to this law, good forms are balanced and complete; while the poor forms tend to be perceived as being like or corresponding good forms but are not. The law of Pragnanz also refers to the tendency to fill in the gaps perceptually when the stimulus is incomplete.

Corollary to the interview to their biology teacher some of their responses to the questions, “*What is the learning style of your students that you have observed in your class?*” are as follows: “*Well, sometime my students immediately supported my discussion but seemingly too broad*” “*What do you mean broad?*” “*Like giving ideas that*

include other topic, however, somehow related to our lesson." "I've noticed that my students like holistic example or discussion rather than the simple or small idea." She also added that "Sometimes they are requesting me to add my discussion in large scope when there is a few minutes remaining from our class dismissal though I think I cannot elaborate them thoroughly." "Most of their answer in the discussion portion of their examinations is unorganized; I hate to read these because it takes me time to get what they mean."

Table 6
Active/ Reflective learning style correlation

	<i>Pearson correlation</i>	<i>Sig. 2 tailed</i>	<i>Interpretation</i>
Maguindanaon & Meranao	-0.076	0.387	Not significant
Maguindanaon & Tausog	-0.387	0.877	Not significant
Maguindanaon & Mixed-culture	-1.00	0.304	Not significant
Meranao & Tausog	0.019	0.803	Not significant
Meranao & Mixed-culture	-0.062	0.525	Not significant
Tausog & Mixed-culture	0.045	0.648	Not significant

The computed Pearson correlation were all having a below 0.05 p-value, which means that there are no differences in the active /reflective learning style among the four cultural groups of respondents. This finding implies that the four cultural groups of respondents were similar in the active learning style. This may infer that the three minority groups have been treated equally in terms of applying the active teaching style. Furthermore, the above similarities of the three minority and mixed-culture respondents in this study may mean that they had acquired these similarities from their Malayan ancestor. This finding is supported by the three authors namely Anderson (1988), Decker (1983) and Hilliard (1989) who claim that that different cultural groups and racial groups prefer learning styles that are indigenous in origins. Similarly, Win, et.al (2008) find in their studies on comparative study of the learning style and educational backgrounds of engineering students that Malaysian student were active learners. Malaysians also descended from Malays, which could also be the descendants of the respondents of this study.

Table 7
Sensing/ Intuitive Learning Style Correlation

	<i>Pearson correlation</i>	<i>Sig. (2-tailed)</i>	<i>Interpretation</i>
Maguindanaon & Meranao	-0.180(*)	0.038	Significant
Maguindanaon & Tausog	0.120	0.170	Not significant
Maguindanaon & Mixed-culture	-0.024	0.808	Not significant
Meranao & Tausog	-0.102	0.186	Not significant
Meranao & Mixed-culture	-0.012	0.905	Not significant
Tausog & Mixed-culture	0.242 (*)	0.012	Not significant

Table 7 showed that sensing/intuitive learning style between Meranao, Tausog and Mixed-culture had no significant difference, likewise in the case of the Maguindanaon, Tausog and Mixed-culture. However, The Meranao and Maguindanaon have a significant difference. This finding would imply that Meranao, Tausog and Mixed-culture had similarities in the sensing/intuitive learning style and only the Maguindanaon differed from them. The findings further mean that among the four cultural groups of respondents only the Maguindanaon and Meranao differ on their sensing or intuitive, perhaps, because they had some cultural differences, which started as early as the enthronement of Timely (local chief) in Maguindanao (Kadil, 2002). This finding is supported by Palispis (2007), who stated that folk belief governs or rule the common social interactions between members of group. Folk belief is a common social interaction and includes the sense of knowledge, assumptions about the world (method) and the student's network (his studies, his classmates, his professor, his school, others). The students' approach to learning is also governed by his folk beliefs, which they inherited from their ancestors.

Table 8
Visual/ Verbal Learning Style Correlation

	<i>Pearson correlation</i>	<i>Sig. (2-tailed)</i>	<i>Interpretation</i>
Maguindanaon & Meranao	-0.032	0.715	Not significant
Maguindanaon & Tausog	-0.074	0.398	Not significant
Maguindanaon & Non-Minority	-0.064	0.510	Not significant
Meranao & Tausog	-0.009	0.908	Not significant
Meranao & Non-Minority	0.046	0.639	Not significant
Tausog & Non-Minority	0.293(**)	0.002	Significant

**Correlation is significant at the 0.01 level (2-tailed)

The results presented in Table 8 would mean that the Maguindanaon, Meranao and Tausog respondents has no significant differences in their visual/verbal learning style. There is also no significant difference in the visual/verbal learning style among the Maguindanaon, Meranao and Mixed-culture respondents. Only the Tausog and Mixed-culture have significant differences in the visual/verbal learning style. Meanwhile, the lifestyle of the Tausog, particularly their students' learning style, was well developed before the Mixed-culture arrived to live with them. This finding is supported by the statement of Gowing (1998) that cultural differences between Muslim (minority) and Christian (mixed-culture) Filipinos are significant, but it is broadly true that they have more common ability with each other. This finding is again supported by Kadil (2002), who cited the genealogy of the Bangsa Moro, that the Bangsa Melayu (Malay race) is part of Alam Melayu (Malay world), which was a part also of Ummah (Islamic world), as well as the Bangsa Moro people.

The results shown in Table 9 would mean that all respondents have no differences in their sequential/ global learning style. This would imply that all respondents were all similar in their sequential/global learning style. Moreover, the above similarities of the three minority and mixed-culture respondents in this study would mean that they had acquired it from their Malayan ancestors. The respondents of this study were all Filipinos who were descended from the Malays, Encarta (2008). This finding is supported by Anderson (1988), Decker (1983) and Hilliard (1989), who said that different cultural groups and racial groups preferred learning styles that are indigenous to them in origin. The results would imply that the three culturally differentiated respondents, namely the Maguindanaon, Meranao and Tausog were similar in active/reflective processing of information, in sensing/ intuitive take in of information, in visual/verbal perception of information, and in sequential/global absorption of information learning styles. This may be true since all respondents were taken in one region of the Philippines under the ARMM jurisdiction. As Panopio et al (1994) state, all cultures are different because they attempt to satisfy the basis of biological and group needs that develop out of the individual's psychic unity, which is drawn from the limited alternatives that are available in one's environment. This will be altered only when the individual suffers from genetic mutation (Kardong, 2010). Espiritu et al, (1996) stresses that different people learn to live in a peaceful relationship, especially when their differences are reduced to the vanishing point through the process of assimilations by which they combine their previous cultures to produce a new culture, which is then common to both groups. This would also infer that due to living together, assimilation and amalgamation is the reason behind having no glaring differences among the Maguindanaon, Meranao and Tausog as well as the Mixed-culture group learning style, because adaptation and adjustment takes place in this processes.

Table 9
Sequential/Global Correlation

	<i>Pearson Correlation</i>	<i>Sig. (2-tailed)</i>	<i>Interpretation</i>
Maguindanaon & Meranao	0.036	0.677	Not significant
Maguindanaon & Tausog	-0.051	0.564	Not significant
Maguindanaon & Mixed-culture	-0.041	0.676	Not significant
Meranao & Tausog (231)	0.084	0.278	Not significant
Meranao & Mixed-culture	0.048	0.626	Not significant
Tausog & Mixed-culture	-0.112	0.252	Not significant

To identify the respondent's orientation in the mentioned learning styles, the researcher employed the Kolb Learning Style Inventory. The researcher used a computed mean to determine the orientation of the respondents in the four learning styles as suggested by Kolb and Fry (1978). In addition, Calderon and Gonzales (2008) also suggested that when relative placements of score or position are desired to be known ranking may be computed.

Table 10 shows that the Maguindanaon and Meranao concrete experience learning style ranked first, while the Tausog are favouring on abstract conceptualization, and Mixed-Culture favouring on active experimentation. On the other hand, the Maguindanaon, Tausog and Mixed-culture were less oriented to reflective observation, while Meranao were less oriented to abstract conceptualization. This would imply that exposing Maguindanaon and Meranao in concrete experience learning activities would probably produce better performance; exposing the Tausog and Mixed-culture into active experimentation learning activities would have a better performance among them. However, exposing Maguindanaon, Tausog and Mixed-culture in reflective observation learning activities would need a simple and deep explanation in order to arrive at a good performance output.

Sims and Sims (1995) state that the acquisition of additional information, skills, or attitudes in learning, to what the student knows already or can do in terms of their present knowledge and skills. Similarly the results were affirmed by the respondents during interviews. The interviews with these respondents on the close-ended question "*Which of the four learning characteristics or styles you are most comfortable in using to process and/or acquiring new knowledge? These are concrete experience, abstract conceptualization, reflective observation comfortable and active experimentation.*" After it was simply explained, elaborated and some examples given to them, Maguindanaon interviewees claimed they were most comfortable in using concrete experience processing of acquiring new knowledge; while the Meranaos were comfortable in using concrete experience processing in acquiring new knowledge; Tausog claimed using concrete experience processing in acquiring new knowledge and Mixed-culture preferred, using the concrete experience processing of acquiring new knowledge as their learning style.

For the abstract conceptualization, the following data were noted: Two (2) of the eight (8) Maguindanaons interviewed were most comfortable in the abstract conceptualization processing in acquiring new knowledge; only one (1) of the nine (9) Meranaos interviewed was most comfortable in the abstract conceptualization processing acquiring new knowledge; only one (1) also of the eleven Tausogs interviewed was most comfortable in abstract conceptualization processing in acquiring new knowledge. On the other hand, only two (2) of the six (6) Mixed-culture interviewed were most comfortable in the abstract conceptualization processing in acquiring new knowledge as their learning style. In the case of reflective observation, only one (1) of the eight (8) Maguindanaons interviewed; two (2) among the Meranaos interviewed, while three (3) out of eleven Tausog and only one (1) of the six (6) Mixed-culture interviewed were most comfortable in the same matter. Moreover, among those most comfortable with the active experimentation used in processing or acquiring new knowledge were two (2) of the eight (8) Maguindanaons interviewed; five (5) of the nine (9) Meranaos interviewed; two (2) of the eleven (11) Tausogs interviewed and two (2) of the six (6) Mixed-culture interviewed.

On the Kolb learning style inventory, the results showed that the learning style of the four cultural groups of the respondents of this study begins from any of the four learning styles and should be approached as continuous or spiral. Kolb and Fry (1975) suggest that the learning process in science, particularly in biology, often begins with a student carrying out a particular action and then seeing the effect of action in this situations, followed by an understanding of these effects in the particular instance so that the same action will be taken in the same circumstances, so that it would be possible to anticipate what would follow from the action. In this pattern the third step understands the general principle under which the particular instances fall when the general principle is understood, the last step being its application through action in new circumstances within the range of generalization. These steps used the Dewey's developmental nature of exercise and Piaget's cognitive development. It is further implied that Kolb's learning styles and Felder and Solomon learning styles are related to each other, although they used different terms, their application and meaning are mutually the same.

Table 10
Respondents' Learning Styles according to Kolb Learning Style

Learning abilities	Maguindanaon			Meranao			Tausog			Non- Minority		
	<i>f</i>	<i>x</i>	<i>Rank</i>	<i>f</i>	<i>x</i>	<i>Rank</i>	<i>f</i>	<i>x</i>	<i>Rank</i>	<i>f</i>	<i>x</i>	<i>Rank</i>
Concrete experience	1397	9.90	1 st	1506	8.86	1 st	1979	8.57	2 nd	955	8.93	2 nd
Abstract conceptualization	1216	9.14	2 nd	1163	6.84	4 th	2204	9.54	1 st	940	8.78	3 rd
Reflective observation	984	7.4	4 th	1291	7.60	3 rd	1587	6.87	4 th	760	7.10	4 th
Active experimentation	1195	8.98	3 rd	1482	8.72	2 nd	1881	8.43	3 rd	1001	9.36	1 st

b. Respondents Performance in the NAT Biology Component

The National Achievement Test (NAT) is an annual examination given by the Department of Education and National Education Test Research Center (NETRC) to both public and private secondary and elementary pupils every March since 2004. The objective of this achievement test is to determine the achievement level, strength and weaknesses of the elementary and secondary students in the subject areas of Filipino, Mathematics, English, Science and Aralin Panlipunan. The score and its corresponding percentage of the second year level of the secondary students in the science-component of this achievement test was used in this study as the dependent variable. Moreover, the mastery level that reflected on the students' certificate of rating was also used to determine the respondents' competency in mastery performance in Biology.

Table 22
Respondents' Kolb's Learning Styles in relation to their Performance in Biology-Component of the NAT

	<i>Sum of square</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>	<i>Decision</i>
Concrete experience LA						
Between groups	34.009	38	.895	0.943	.943	Not significant
Within groups	572.645	599	.956			
Total	606.654	637				
Abstract Conceptualization LA						
Between groups	33.677	38	.882	1.034	.447	Not significant
Within groups	519.798	599	.868			
Total	553.473	637				
Reflective observation LA						
Between groups	39.222	38	1.032	1.1398	.279	Not

Within groups	542.314	599	0.905			significant
total	569.820	637				
Active experimentation						
Between groups	33.404	38	.879	1.079	.379	Not
Within groups	498.843	599	.833			significant
Total	532.247	637				

The results showed the both Minority and the Mixed-culture respondents of this study never reached mastery level of “mastered” and “closely approximately mastery” of the NAT. The null hypothesis: There is no significant relationship between the performances of the respondents in biology component of NAT with their learning style, which is accepted in sensing/ intuitive and sequential/ global learning style and rejected in active/ reflective and visual/ verbal learning style. These results would imply that the respondents were deficient also in mastery of their biology subject. Their poor mastery performance in all subject areas in the National Achievement Test, NETRC (2008) is also indicative of deficient mastery in their biology subject. However, despite their having poor performance in biology, none of them were found in the “absolutely no mastery” levels.

The result presented above implies that the learning characteristics of the respondents cannot influence their performance in the biology-component of the NAT. This finding would further imply that the orientation of the respondents towards the four learning characteristics do not have a correlation to the mastery performance in biology component of the NAT. This would also mean that whatever the orientation of the respondent in the four learning characteristics, it cannot hinder nor influence their performance in biology component in the NAT. Thus, whether the teaching style is aligned or not aligned to the respondents’ learning characteristics, it could not influence their performance. This finding is similar to the findings of Castro and Peck (2005) when they analyzed the distribution of grades according to learning style. They found no significant correlation between learning style and grades. Likewise, Tights_(2007) studied English college students learning Spanish and showed that students performed equally well on vocabulary test regardless of perceptual learning style preference.

Conclusions

Based on the findings of this study, it is concluded that the relationship between the mastery performances of the four cultural groups of second year high school students in the biology-component of the NAT in sensing/intuitive and sequential/ global learning style is not significant while the relationship between the mastery performances of the four cultural groups of second year high school students in the biology-component of the NAT inactive/reflective and visual/verbal learning style is significant. The relationship between the mastery performances of the four cultural groups of second year high school

students in the biology-component of the NAT in their four learning style according to Kolb's learning style inventory namely concrete experience, abstract conceptualization, reflective observation and active experimentation is not significant.

Other results reveal that majority of all respondents preferred the strongly and moderately active learning styles, the strongly and moderately intuitive learning style, strongly and moderately verbal learning style; and strongly and moderately global learning style. Another revealed finding is that the Meranao and the Maguindanaon as well as the Tausog were more oriented in concrete experience which is another indicator of intuitive learner, while the Mixed-culture respondents is among the four learning characteristics oriented to active experimentation, which is an indicative of active learner. The four cultural groups have no difference in active/reflective and sequential/ global learning style. For sensing/intuitive learning style, only the Meranao and the Maguindanaon had a difference. For visual/verbal learning style only the Tausog and the Mixed-culture had difference.

Every teacher aspires that all his students could learn. This aspiration may be reached when teacher and student followed the same path. One of the keys towards quality education is the upgrade of the teacher profession in his field of specialization, particularly sciences, that deals with facts, either pursuing a master's degree, a doctoral degree and/or attending a seminar-workshop. It is highly recommended that the science teacher, particularly, of biology, must be updated, because the young generation today is leaping with knowledge. Another key is aligning the biology teacher's teaching style or strategy according to the student's learning style. However, Philippine education, particularly in ARMM, was deals with a large class that comprises of students with different learning styles. Grouping or sectioning of students is not a learning style base but performance-based, such as the entrance examination of the school. Besides, this study has found that certain respondent of this study exhibited one or more of the Felder and Solomon four dimensions of learning styles. Dunn and Dunn Learning Style Models were also noticed in the interview done with them. The Visual, Auditory and Kinesthetic (VAK) were also noted among the respondents. So the result of this study is a good source of information for educational change or reform among teachers, curriculum makers, students, and all other stakeholders in the academe.

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