Investigating Students' Learning Styles: A Pilot Study

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Abstract - The purposes of this study are to measure the reliability of the Indonesian-translated VARK questionnaire, to investigate students' dominant learning styles, to find out whether students' learning styles are different based on their genders, and to find out whether the differences in GPA among students whose different learning styles. The data were collected through administrating Indonesian-translated VARK questionnaire to accounting department students of Pontianak State Polytechnic. This study finds that the translated questionnaire is not reliable to measure students' learning styles based on the sensory modalities. This study also finds that the students had various learning styles which had insignificant difference in their gender and academic achievements.

Keywords: VARK questionnaire, learning styles.

I. BACKGROUND

Despite the importance of recognizing students' learning styles, teachers of accounting department of Pontianak State Polytechnic seem to conduct their teaching and learning process based on their convenience and teaching experience to cater for all students' learning styles. They assume that their varied teaching methods are sufficient enough to accommodate students' learning preferences. This is in line with many scholars' studies such as as Al-Balhan (2010), Graves (2000), Richard and Lockhart (1996), Vincent and Ross (2001) and Zheng (2009), which found that teachers tended to teach based on their beliefs in how students should learn.

Varying their teaching methods is reasonable because it is admitted by education practitioners that it would be very inefficient and costly if all students have to be assessed and put in different classes according to their learning preferences because schools will need more budgets for additional teachers with specific skills to teach students with certain learning styles (Pashler, McDaniel, Rohrer, & Bjork, 2009). Seeing these inefficiencies, teachers generally tend to teach their students based on their beliefs, intuitions and experiences to cater for all students' learning styles.

This pilot study was intended to investigate accounting students' learning styles by identifying their dominant learning preferences and finding out the differences between male and female students' learning styles. This study also tried to find out whether, based on teachers' varied teaching methods, there was difference in GPA between students whose different learning styles. Importantly, this pilot study was intended to measure the reliability of the Indonesian-translated VARK questionnaire.

In responses to the purposes the following research questions are presented: (1) is the Indonesian-translated VARK questionnaire reliable to be used as an instrument to measure students' learning preferences? (2) what is the dominant accounting students' learning style? (3) do female and male students have different learning styles? (4) is there a difference in GPA among students whose different learning styles? This study was also to test two null hypothesis: (1) there is no significant difference in learning styles between female and male students and (2) there is no significant difference in GPA between students whose different learning styles. However, this study was limited by time, budget and school permission. Consequently, this study did not cover broad study of teachers'

teaching styles. It was only focusing on the investigation on students' learning styles, not assessing the correlation between students' learning styles and their academic achievement.

By recognizing students' learning styles and their differences in genders and achievements, the management of the school and teachers within it, would be well informed whether the students have one or more dominant learning preferences. This study would also inform students' achievements (GPA) relating to their different learning preferences. Therefore, a school policy could be developed to accommodate all students' learning. The policy might be in terms of radical changes on teaching method and instructional designs or just strengthening the existing teachers' teaching approaches.

Regarding to students' learning styles, Fleming (2001b), the developer of VARK questionnaire explains that students will learn best using their sensory modalities. Students with a V (visual) style will learn best if the information provided in graphs, charts, maps, designs, arrows, diagrams, patterns, flow charts and every visual media. Learner that prefers A (auditory) style will learn much faster if the information provided in tutorials, lectures, email, web chat, group discussion, and other talking things through. An R-type (read/write) student will learn much easier if most information is delivered in words while K-type (kinaesthetic) suits students who prefer information provided in demonstrations, simulations, videos and movies of real things, as well as case studies, practice and applications.

Fleming (2001b) further states that some people might have one strongest learning styles. However, many have strengths in two or more learning styles. The combination of more than one learning styles is known as multimodal refers to bi-modal for two combination, tri-modal and quad-modal for combination of three and four learning styles. Multimodal learners are more flexible on how they take new information than single learning style. They are more able to adapt with whatever teaching approach used by teachers.

Students as individuals have different learning style preferences, and these preferences may be different between male and female students. Earlier studies conducted by some scholars showed that there are a variety of findings in the significance of male and female students' preference learning styles. Some findings indicated that there were differences between male and females students (Dobson, 2009; Severiens & Dam, 1994; Wehrwein, Lujan, & DiCarlo, 2007). However, others found different results that there was no significant difference in learning styles between males and females (Severiens & Dam, 1997; Shaw & Marlow, 1999; Slater, Lujan, & DiCarlo, 2007). In terms of students' achievement, students' learning styles ideally should be accommodated to encourage students to have better achievements (Pashler, et al., 2009). This was proved by Dunn, et al. (1995) cited in Al-Balhan (2010), Santo (2006) and Vincent and Ross (2001). They found that accommodated learning styles help students improve their achievements.

II.   METHOD

This study used survey design and to answer the research questions and test the hypothesis, hard copy of Fleming's (2001a) the Indonesian-translated VARK questionnaires ware administrated to students. The questionnaire comprised 16 questions. Every question distributes four items to measure students' sensory modals – visual, aural/auditory, read/write, and kinaesthetic. As a result, the overall is 64 items. To determine which item asking which sensory modal, Gardner, Jewler and Barefoot's (2009) explanation on the sensory modal category for each item was used.

Table 1
VARK Modality Distribution in Questionnaire

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16
Visual	d	a	b	c	b	c	c	d	a	c	d	a	d	b	d	d
Auditory	b	b	d	b	a	d	b	c	c	a	b	b	c	d	b	c
Read/Write	c	c	c	d	d	b	d	a	b	b	c	c	a	c	c	b
Kinesthetic	a	d	a	a	c	a	a	b	d	d	a	d	b	a	a	a

*Q = question

For the purpose of statistical analysis, the students' responses were scaled using Likert Scale that was not supplied in original Fleming's model. The scale range used ordinal scale of 5 choices, ranging from strongly disagrees to strongly agree. In addition, two questions, asking about gender and GPA, were added in the questionnaire, and some items were reworded to meet the nature of the research site.

The study involved semester III students of accounting department of Pontianak State Polytechnic. The students were selected on the basis of fulfilling what the study intended to assess and school permission. Semester III comprised 117 students (52 males and 65 females). To anticipate time and budget limitation, there were only 80 questionnaires distributed. The students were picked students randomly from four classes. The number of males and females as targeted sample was proportional.

Paper-based questionnaire was administrated to the students after their class hour. The students took the questionnaire and answered the questionnaire outside the class. Of 80 students there were 66 of 80 (82.5% response rate) volunteer students (35 males and 31 females) returned their completed questionnaires. This response rate from the students is sufficient to make a conclusion on students' learning styles.

III.   RESULTS

Both SPSS 18 and Microsoft Office Excel were used for the purpose of data analysis. Prior to testing the hypothesis, an exploratory factor analysis was run in SPSS 18 to explore interrelationship among a set of variables. Reliability analysis was also run to see if the Indonesian-translated VARK questionnaire was reliable to use as an instrument to measure students' learning styles. Microsoft Office Excel was used to assess the students' dominant learning style and their learning style combinations and to compare male and female students' learning styles in percentages. The students' dominant learning styles were determined by calculating each student's responses of every item and calculating the percentage using percentage formula in Microsoft Office Excel.

The students would be determined to have one or more learning styles if they scored ☐ 25%. For instance, a student would be categorized as ARK learner if she or he scored V = 24%, A = 25%, R = 26% and K = 25% of all items. In addition, to find out the significant differences between male and female students' learning styles a t-test using SPSS 18 was conducted. A t-test was also conducted to assess the students' GPA differences based on their dominant learning styles.

Findings

Instrument Validity and Reliability Analysis

The content validity of the questionnaire did not change although it had been translated into Indonesia. Every question had four items (a, b, c, and d) to measure students' sensory modals – visual, aural/auditory, read/write, and kinaesthetic (see table 1). Therefore, its content validity is sufficient. Besides, it has been approved by the human investigation committee of the institutional review board at the university with Project Approval No. X06-809 (Wehrwein, et al., 2007).

To assess the inter-correlation variables and scale's internal consistency of this Indonesian-translated VARK questionnaire, exploratory factor analysis and reliability analysis were executed. Prior to assessing the questionnaire, grouping all items into four variables of learning style modalities (as showed in table 1) had been done. All items were also rechecked to make sure that the data were normally distributed and to make sure there was no item that had to be reversed.

Results from factor analysis indicated that this questionnaire was not suitable to be measured with this analysis. Factorability of the correlation matrix did not show sufficient correlation, in which most of correlations of r were less than .3. Besides, the Kaiser-Mayer-Olkin (KMO) values (see table 2) also did not support that factor analysis was suitable for analyzing items of this questionnaire, less than .6.

Table 2

KMO values of Indonesian-translated VARK Questionnaire

	Visual	**Auditory**	**Read/Write**	**Kinaesthetic**
KMO Values	0,5	0,48	0,55	0,49

Using SPSS reliability analysis revealed that the internal consistency of the Indonesian-translated VARK questionnaire was not reliable for only the visual subscales reached .70 Cronbach's alpha. Other subscales were below the cut-off value of .70, presented in table 3. Removing one item of each subscale did not show significant reliability (Cronbach's alpha) improvement.

Table 3

VARK Reliability Analysis

VARK Variable Subscales	**Cronbach's alpha**	**Cronbach's Alpha if Item Deleted**	
Visual	.70	Removing item 2a	.71
Auditory	.60	Removing item 10a	.62
Read/Write	.68	Removing item 11c	.69
Kinaesthetic	.60	Removing item 13 b	.62

Students' Dominant Learning Styles

Figure 1 shows students' dominant learning styles in percentages. The students' dominant learning styles are VAR tri-modal style, which is the combination of visual, auditory and read/write modes, and AR bi-modal style, which is the combination two styles – auditory and read/write. VAR represented 26% and AR represented 18% of all samples. Other preferences are VRK (14%), ARK (14%), VAK (9%), VR (6%), AK (6%), VA (3%), VK (1%) and interestingly, there were only 3% of the samples whose quad-modal style, which is the combination of four learning and none of them prefer uni-modal.

The students' dominant learning modes are also presented in the figures. It is obviously seen that most students prefer multimodal learning styles (tri-modal, 62% and bi-modal 35%) to quad-modal, 3%.
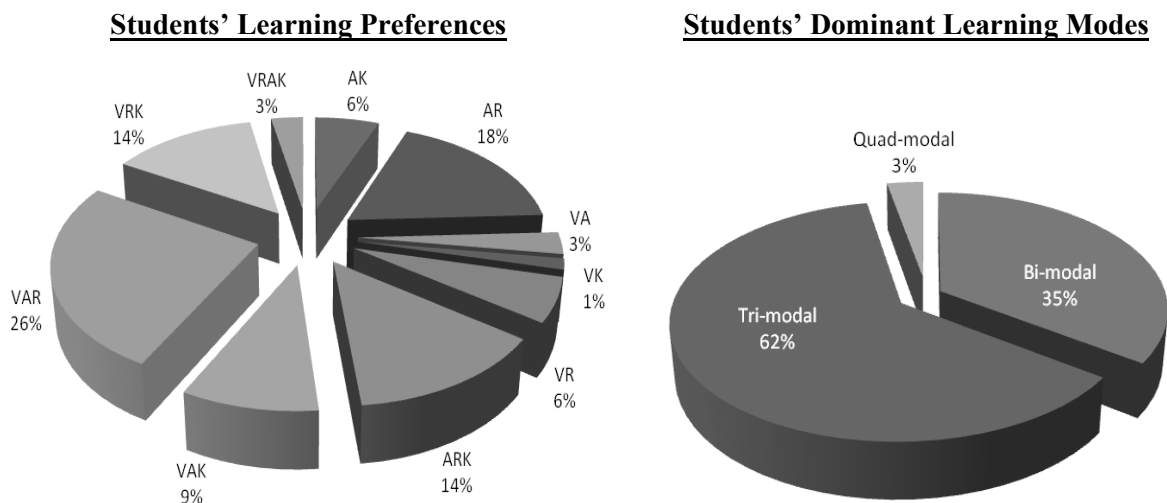

Figure 1. Students' dominant learning preferences

Difference in Gender and Achievement

To assess whether there was a significant difference between male and female students' learning styles (visually presented in figure 2 and 3), a t-test using SPSS 18 was conducted. Figure 2 visually shows that there were not many differences between males and females dominant learning preference modes. Most of students preferred tri-modal, males 62% and females 67%, to bi-modal, males 38% and females 33%.
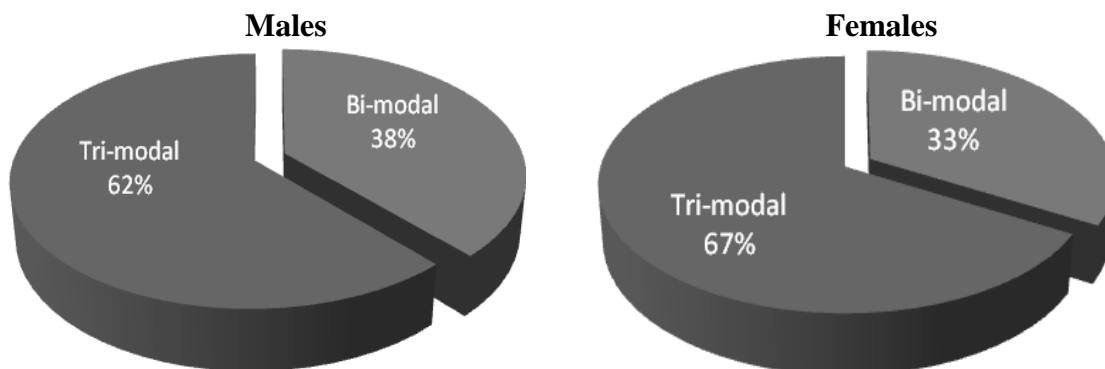

Figure 2. Males and females dominant learning preferences modes

As presented in figure 3, it can be seen that there were differences between males and females in terms of their learning multimodal styles. Of 26% of all samples whose VAR preference and 18% of them whose AR learning styles (see fig. 1); 53% of males (or 12% of all students) preferred AR, and 47% preferred VAR (or 11% of all students) respectively and most females preferred VAR, 71% (15% of all students) to AR, 29% (6% of all students).
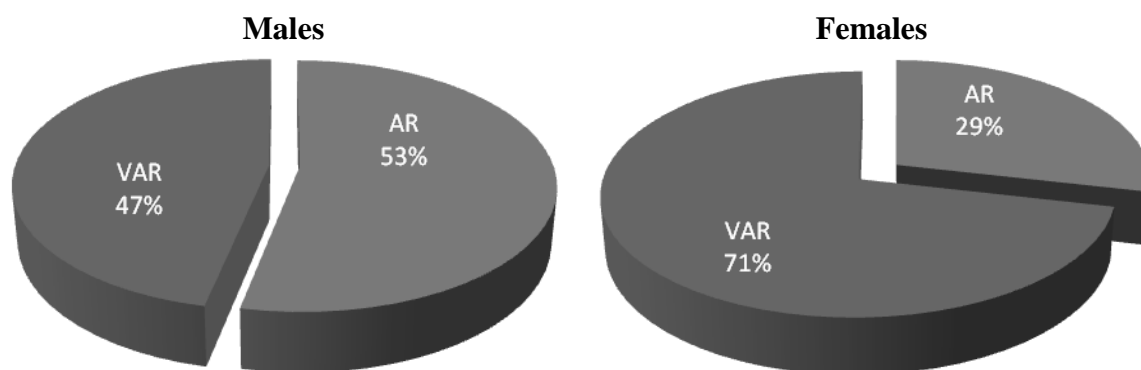

Figure 3. Males and females dominant learning styles

However, statistical analysis, presented in table 4, indicates that there was no statistically significant difference in students' dominant learning styles (Sig. (2-tailed) = .69, larger than the cut-off of .05); males (M = 1.62, SD = .49) and females (M = 1.67, SD = .48). In addition, there was also no significant difference in students' dominant learning preference modes (Sig. (2-tailed) = .19) in score for males (M = 1.47, SD = .52) and females (M = 1.71, SD = .47). Table 4 also shows that the Equal variances assumed which means that the equal variances has not violated, Sig. Value is larger than .05.

Table 4
Independent sample t-test score for students' dominant learning preferences and learning preference modes

Gender	Dominant learning styles (VAR and AR)				Dominant learning preference modes (bi-modal and tri-modal)			
	Mean	SD	Sig. Value	Sig. (2-tailed)	Mean	SD	Sig. Value	Sig. (2-tailed)
Male	1.62	.49	.42	.69	1.47	.52	.10	.19
Female	1.67	.48			1.71	.47		

Table 5
Independent sample t-test score for GPA difference between students whose different dominant learning styles (AR and VAR)

Dominant learning styles	Mean	SD	Sig. Value	Sig. (2-tailed)
AR	5.25	1.42	.28	.62
VAR	5.00	1.22		

Prior to assessing the difference in GPA between AR and VAR students, students' GPA score was checked and it was found that the scores were normally distributed (M = 5.26; SD = 1.25). As presented in table 5, independent sample t-test shows that there was no significant difference in GPA between students whose different dominant learning styles (AR and VAR), Sig. (2-tailed) = .62 respectively, in which for students with AR preference (M = 5.25, SD = 1.42) and for students with VAR styles (M = 5.0, SD = 1.22). The table also indicates that Sig. value = .28, which mean the Equal variances assumed. As a result, first and second null hypothesis are accepted.

IV.   DISCUSSION

The research finding confirms that the Indonesian-translated VARK questionnaire was not suitable to analyze using factor analysis since its factorability of the correlation matrix did not show sufficient correlation, most of r = < .3, and the Kaiser-Mayer-Olkin (KMO) values were under the cut off value of .6 (V = .50, A = .48, R = .55, K = 4.9).

The inappropriateness of using factor analysis was not due to invalidated data since prior to running factor analysis all data had been rechecked, including checking reversing scales, the normal distribution and confirming all items were group together based on their modality groups. It was assumed that the inappropriateness was due to the sample size of this study (66 participants). Factor analysis, according to Pallant (2009), runs appropriately if sample size of a study is ☐ 150 or the number of samples represent a ratio at least five cases for each of the variables. Thus, it is assumed that this study should have had at least 320 participants, 5 cases time 64 items, for a factor analysis.

Besides, this study revealed that, in spite of its content validity, the Indonesian-translated VARK questionnaire was not reliable to use as an instrument to measure students' learning styles. This study found that subscales value for auditory, read/write and kinaesthetic items are less than the cut off value of .7 Cronbach's alpha, except for visual subscale, .71, respectively. Although it was suggested in SPSS to remove one item of each variable, it still did not provide reliable Cronbach's alpha value.

The findings on Cronbach's alpha values of the Indonesian-translated VARK questionnaire were different from Dr. Leite's estimation. Fleming (2001c) asserts in VARK website that according to Dr. Leite's study, that the reliability score of the VARK subscales were 'estimated' 0.85, 0.82, 0.84 and 0.77 for the Visual, Aural, Read/write and Kinaesthetic subscales, respectively.

The reliability limitation of this translated questionnaire aligns with other study finding. Breckler, Joun, and Ngo (2008) also admitted that VARK questionnaire had limitation in its reliability. They explained that "VARK is not a complete learning style inventory but rather provides users with a simple profile of their basic sensory learning preferences" (2008, p. 30). The limitation is also admitted by the developer. In the website he states an invitation that he and co-developer are expecting researchers to test the reliability of VARK questionnaire (2001c). This limitation is admitted due to the questionnaire structure, which comprises of multiple items within a question. Besides, the researcher assumes that the number of items (64 items, 4 items times 16 questions) is too many for the students. The students seemed to be tired to complete the questionnaires. Consequently, they tended to respond by paying less attention to the questionnaire. Due to the reliability limitation and problems, a future pilot study is needed.

Despite its limitation in   reliability, recognizing students' learning preferences is still necessary for pedagogical reasons. This study shows that the students' learning styles varied from bi-modal to quad-modal. It means that in general students had mixed learning styles. However, the most dominant learning preference modes were tri-modal (62%) and bi-modal (35%). Interestingly, the students did not prefer quad-modal for only 3% of them preferred combination of V, A, R, and K, and none of the preferred uni-modal as their best ways of learning based on their sensory modalities. In

addition, as their dominant learning styles, this study shows that the students preferred VAR tri-modal style (26%) and AR bi-modal style (18%)

From students' dominant learning styles (tri-modal VAR and bi-modal AR), assessments on the differences in gender and achievement were conducted. Descriptive statistic, visually presented in pie charts (figure 2 and 3), shows that were small difference between male and female students in their learning preference modes (males = 62% tri-modal and 38% bi-modal; females = 67% tri-modal, 38% bi-modal). In addition, statistical analysis using a t-test indicated that students learning styles did not vary between male and female students. The t-test scores showed that there were no significant differences in males and females' dominant learning preference modes (tri-modal and bi-modal) and their dominant learning styles (VAR and AR).

This research finding is contradictory with prior assumption that every student has his or her own learning styles and this preference might be different in gender. Other contradictories are with previous studies, which showed that there was significance difference between male and female students' learning styles, Severiens and Dam's (1994) study, for instance. Later studies by Wehrwein, et al. (2007) and Dobson (2009) also do not support this research finding. They found that male and female students preferred different sensory modalities in taking in and processing new information.

Despites, this finding does support previous study conducted by Shaw and Marlow's (1999), who measured students' learning styles using Honey and Mumford learning style model. Their study revealed that there was no significant difference between male and female students' learning styles. Earlier study also claimed the same findings. Study by Severiens and Dam (1997) did not find any evidences that male students had significant different learning preferences from their female counterparts. A later study by Slater, Lujan, and DiCarlo (2007) also supports this research finding. The scholars did find that there was no significant difference in students' learning styles based on their genders.

The last finding of this study is that there was no statistically significant difference in students' achievement (GPA) between those whose different dominant learning styles (VAR and AR) under teachers' teaching approaches based on their beliefs, intuitions, assumption and teaching experiences. This finding does not align with another prior assumption, which is usually called learning style hypothesis, in which a certain student's learning style should be catered for according to his or her learning preference to get maximum academic achievement. The hypothesis means that students will fail if they are not accommodated specifically according to their learning styles. In other words, this research finding does not prove that students with certain learning styles will not get benefit from teaching approaches which match with other learning styles.

This research finding, however, supports previous current study by Pashler, et al. (2009) who claimed that there was no enough evidence from any previous studies that students with certain learning styles only benefited from an instructional method, which suited their learning preferences. This was also supported by Mayer (Mayer, 2009) who believed that there was no strong evidence that students' with visual learning style only learn better with visual and pictorial teaching method and students with read/write learning style only get benefit from text-based method. Therefore, although it is admitted that students might have different learning styles, providing various teaching approaches, managing classroom and providing good classroom atmosphere are necessary for teachers to do.

Above all, this research finding justifies that varying teaching method by an assumption to cater for all students learning preferences will be the best choice for Pontianak State Polytechnic teachers in conducting their teaching and learning process. Besides, it is costly, time-wasted and inefficient for teachers and school management to cater specifically for specific students' learning styles.

V.   CONCLUSION

Findings from this study conclude the Indonesian-translated VARK questionnaire was not a reliable research instrument for measuring students' learning preferences based on their sensory modalities. In spite of its reliability limitation, it shows that students had various learning styles in which their dominant learning preferences were tri and bi-modal styles, which were the combination of visual, auditory and read/write (tri-modal VAR) and combination of auditory and read/write (bi-modal AR). From the dominant learning styles, it was found that there were no significant differences in gender and their academic achievements.

As a result of this study, some implications for teachers' catering for students' learning styles need to be addressed. However, these research findings do not cover a broad of study on students' learning styles, teaching methods and other influential variables. Importantly, the study recommends the teachers to strengthen their varied teaching approach to accommodate all students' learning preferences and provide their teaching and learning process with good classroom atmosphere.

Since this Indonesian-translated VARK questionnaire has low reliability scores, it is necessary to conduct another pilot study in the future. The future pilot study needs to consider the reliability limitation of this questionnaire. Therefore, restructuring and simplifying the questionnaire is necessary for a simple statistical analysis. Restructuring the questionnaire means changing the structure of the questionnaire from multi item in a question to single item in one question, whereas simplifying means reducing the number of items into adequate numbers (from 64 items into 16 items). This number reduction is supposed to avoid students' exhaustion in filling in the questionnaire. Nevertheless, to maintain the content validity, all restructuring and simplifying the questionnaire have to be on the basis of the original questionnaire.

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