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Can the use of Kali Linux Penetration Testing tools be affected by Learning Styles: The relationship between usage of Kali Linux Penetration Testing tools and Learning Styles in Saudi Arabian Universiti

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Abstract

Usage of technology in our daily life is increasing rapidly in recent years. One of the main techniques to train penetration testing according to learners learning styles. Knowing the style of the learner encourages processing and understanding of the information. This research aims to explore the preferred learning style of students of penetration testing, measure the relationship between students' learning styles and students' performance, and validate the research results by interviewing experts. The instruments used in this research were both VARK questionnaire, exam tests, and interviews. A significant correlation was found between "Visual" learning style and student's performance, and a significant correlation between "Kinesthetic" learning style student's performance. In contrast, other learning styles did not show any significant correlation with student's performance. The researcher recommends taking into consideration students' learning styles when training them in Penetration Testing as every individual student learns differently.

KEYWORDS: Computer Science, Cyber security, Kali Linux, Pen-Testing Tools, Learning styles, VARK, Training Penetration Testing, Ethical hacking tools, Computer Security

INTRODUCTION

Usage of technology in our daily life is increasing rapidly in recent years. Modern life needs such as banking, communication, tourism, studying abroad, and politics enforce us to use secure technology. Learning cybersecurity is a necessity. One of the main techniques to train Penetration Testing is to train according to the learner's learning styles. One of the important motivations for learning is Learning Styles. It attracts students to learn effectively. Hawk and Shah said that using his own preferred learning style can improve learning and performance. Knowing the style of the learner encourages understanding of the information [1]. Students' learning styles should fit their needs. When teachers apply to learn styles while teaching, they can process information better and more effectively among learners [2] because individual differences are accepted between the learner's learning styles and abilities, teachers must find an appropriate method to fulfill the learner's needs [3]. This research aims to show the preferred learning style to a student, find out if there is any relationship between learning styles and performance, and see the differences in gender between female and male on learning style. Every individual student learns differently. Their preferred learning style can influence the achievement of students. Every learning style has its own strength; No learning style is better than the other. This research results are expected to recommend instructors to pay particular attention to the learning styles of their learners, and students to know their best method of learning.

Research Questions

This research is looking for the answer of the following questions:

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RQ1 - Which learning style students prefer most in Penetration Testing learning?

RQ2- Is there any significant relationship between learning styles and performance?

RQ3- Is there any difference between males and females on learning styles?

This study starts with the first section, which is the Introduction. It shows the significances, problems, and goal of the study. Then, Section 2 discusses the study's literature reviews, which include; learning styles, Penetration Testing learning, and the VARK model. Section 3 presents the research methodology, which describes tools used, data collection methods, and participants. Next, Section 4 shows the results and discussion. Section 5, in the end, shows the conclusion and recommendations.

LITERATURE REVIEW

Kali Linux Penetration Testing Tools

Penetration testing is an accepted artificial cyber-attack on a computing device to determine the system's Security [32]. It is referred to informally as pentest or ethical hacking. The primary purpose of penetration testing is testing the system or a network to prove how vulnerable that system or "target" would be to an actual attack [32].

Kali Linux is a Linux-based OS for digital forensics and penetration testing from the Debian distribution of Linux [33]. Offensive Security is a company responsible for its maintenance and support. Since Kali contains hundreds of techniques designed for performing various information vulnerability tests, security analysis, computer forensics or reverse engineering, Kali Linux is mainly used for advanced penetration testing and hacking purposes.

There are various methods to use Kali Linux penetration testing tools [34], the most common method: Command Line Interface (CLI), where the penetration tester types command in the terminal using the keyboard. For example Nmap [35], and SQLmap [36]. The second method is Graphical User Interface (GUI); this method enables the user to select from windows components using keyboard and mouse, it shows components such as buttons, scrollbars, fill text boxes, dropdown menus. OWASPzap [37], ZenMap, Wireshark [38], and Burp Suite have a graphical interface. Web based application (WBA) is a style where the penetration tester uses an internet browser. It provides hyperlinks, photos, videos, and the content used normally in any website. One of the tools used in WBA is shodan [39]. A penetration tester can use programming or scripting, such as python programming language. It provides penetration testers with the ability to automate, write powerful scripts. Python [40] can be used in all the stages of hacking, starting from information gathering till exploitation.

Learning styles

Technology acceptance in education has resulted in computer-based learning systems. Computer-based learning systems have been proven to increase learning efficiency and effectiveness in special education fields [4]. MSP interventions have been integrated into computer-based training programs that have the advantages of being both didactic and recreational simultaneously [5].

[6] used computer-based training through audio-visual material and improved reading skills in seven-year-old children. Computer-based learning software consisting of audio-visual phoneme discrimination tasks has been used to improve reading and writing skills [7]. A Dutch group showed the effectiveness of the multimedia program in learning words in children. It argued that practicing with the program's visual preview was as effective as

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practicing with spelling pronunciations [8]. [9] concluded that multisensory teaching methods and strategies inspire learners by involving and motivating them to use more of their senses. The efficacy of the teaching methods for multisensory spelling has been studied. Pre-Post assessments of two spelling inventories, which took note of weekly dictated sentences, and writing samples from students were analyzed to collect the research data. Findings resulted in support for the use of multisensory training to build spelling skills and improve subsequent writing tasks. Every person has his ability to learn. Studies show that learning skills help people to gain Knowledge differently. Williams James and Carl Jung discovered a concept of learning styles. The Learning Styles concept began in the 1970s, but it became widely known during the 1980's and 1990's [10]. Researchers of learning styles explain how the individual process is done. Students get the information by different preferred methods [11; 12]. Gregorc defined learning styles as specific behaviors, which indicate a person and how he learns to adapt from his environment. It shows how a learner's mind operates [13]. Grasha defined learning styles as: "personal qualities that influence a student's ability to acquire information, to interact with peers and the teachers, and otherwise to participate in learning experiences" [14]. There are many definitions for learning styles. Keefe emphasized that the discussion and interest in learning styles emerged as an essential element to "make learning and instruction more responsive to the needs of individual students" [15]. James and Gardner define learning style: "the complex manner and conditions under which learners most efficiently and most effectively perceive process, store, and recall what they are attempting to learn [16]. According to Dunn and Honigsfeld, learning style can be defined as a "biologically and developmentally determined set of unique characteristics that make the identical instruction effective for some students and ineffective for others"[17]. Keefe defined learning styles as the "characteristic cognitive, affective, and psychological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment" [18].

VARK

VARK is a model of learning styles introduced and developed by [19]. It is concentrated on four learning styles of VARK; visual (V), aural (A), read/write (R), and kinesthetic (K). These learning styles show students' learning style preferences on learning. Auditory or aural students do their best to hear details. They like music, listening to rhythms and rhythm, and they prefer to speak with others during their study groups. They are easily influenced, but they are quick to concentrate on any audible information they can obtain and hold in order to learn. They listen well to tape lectures or engage in verbal debates and discussions [20]. Visual students want to see something. They love graphs, maps, photographs, and pictures that you can store in their minds, which help them remember important images, locations, and other things. Visual learners absorb information best from something they might take in through their eyes [21]. Kinesthetic students are those who like some practical experiments or laboratory work so that they grasp the knowledge that is in front of them fully. They are generally seen as restless students, as they have to keep their minds or their hands busy so that their best work is possible. Anything they need to move about, provide immediate feedback, and touch will work well for kinesthetic students [22]. A student might show multiple learning style preferences or show no preference at all. Students who are described as visual learners learn best when using materials like graphs, photos, and pictures, aural students prefer to learn through listening to sounds and discussions; read/write students prefer writing and reading from printing words; kinesthetic students prefer concrete examples and applications. VARK questionnaire consists of 16 questions to determine a student's preferred learning style of receiving information. Each VARK question contains four multiple choices. Each answer represents a model preference. All answered are counted to identify which learning style is preferred to employ when learning or presenting the information.

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The questionnaire counts the total number of answers that indicate a preference for each model. A model preference is determined by establishing the numerical dominance of one model over the other. For example, if a student selects eight visual answers, two read/write answers, four aural answers, and two kinesthetic answers, they would be considered a visual learning style preference. VARK theory examines how the human mind works. VARK states that the learner receives information after it becomes processed through the human mind. VARK (which Fleming developed in the late seventies) is another model that supplies learners with a sketch of their learning preferences. [23; 19].

The preference guides the user to interact with the learning process and get the information. VARK stands for **(V)** Visual or **(A)** Aural or **(R)** Read/Write or **(K)** Kinesthetic. The learning style may change according to age, travel, relationships, or other factors, but the basic preferences are usually unchangeable. VARK questionnaire results treat users differently according to their preference. Experiments stated that gender could affect the learning style; men are more kinesthetic, while women are Read/Write. VARK shows the perceiving of the information. A person who works in the designing field has a more visual style, while a person who works with texts has a more Read/Write style and so on.

Learning and Technology

Technology, several years ago, entered the school. It can be used as a forum for study, interaction, building, and language [24]. Early technological initiatives included equipping classrooms with devices like overhead projectors, cassette players, and basic calculators. These devices were meant to help conventional learning and teaching paradigms and typically did not encourage students to communicate directly with technology. More recently, a broad variety of technical resources became available, including computer-assisted instruction technologies, i.e., the use of computers for tutorials or simulation exercises provided in replacement or as a complement to teacher-directed instruction and computer-based instruction, i.e., the use of computers in instruction delivery [25].

RESEARCH METHODOLOGY

It is argued that several metaphysical beliefs represent the field of sciences in which interpretivism, positivism, and realism are the most prominent ones [26]. Moreover, the term epistemology demands scholars to objectively analyze the truth by investigating the outcomes regardless of their personal opinions. However, a number of scholars have revealed that the adoption of positivist approach involves quantitative research methods which aim to investigate the relationship between the understudy variables [27]. The interpretive approach, on the other hand, reflects the analytical thought about the positivism philosophy. The interpretive approach also highlights the multifaceted nature of the business world which cannot be analyzed and dominate by laws and theories. Based on this idea, [28] state that a simple fact contains several truths and interpretations that can be applied to different situations and are appropriate to address various research issues. According to [29], a research philosophy consists of different aspects. For example, people from different backgrounds have different living standards, different social, cultural environments, personalities, and family groups that shape an individual's personality. Eventually, the realism approach focused on the linkage between human values and ideas that actually exist in the real world. It has also been reported that the realism approach only supports evidence-based policies and practices. The realism approach makes an assumption that all the national interests should be considered as moral concerns including health and social care. According to [30] the realism approach also determines how individuals behave when confronting a real-world situation. Thus, based upon the qualitative nature of our study, the interpretive approach is used to conduct this study due to its popularity in the sciences.

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The methodology section describes the general research methodology used in this research, which is achieved in many steps. First, the researcher conducted an extensive literature review to narrow down the topic and revise the literature until the submission of this research. The literature review process involved identifying current research question, analyzing, evaluating, and interpreting all related works relevant to the learning style and VARK model. Further elaboration was conducted by finding an answer to some interesting questions about this topic.

Based on the above analysis, three research questions were addressed and justified in section 0. The research question's importance is to identify the extent of current learning techniques and identify the gaps to throw light on what has to be focused on future learning techniques. Next, the researcher contacted Shaqra University officially to get permission to conduct the research. According to the context of the study, questionnaire, tests, and interviews were chosen as data collection methods. Questionnaires are one of the most widely used research instruments [31]. The participants of the questionnaire were selected based on the course offered by the college. The questionnaire of VARK learning style was used and distributed to participants in a controlled environment.

VARK questionnaire was selected because its system focuses on one dimension of learning style. It shows how to absorb and deliver information. We analyzed VARK questionnaire that my samples answered depending on the questionnaire that [19] developed. It is comprised of sixteen questions that can show the model preferences. After a while, a placement test was given to the participants. The output of both the questionnaire and the test and all data related to the research questions and the broader aims of the study were carefully extracted. The study's main aim was to test the correlation between the learning style and performance and test the difference between males and females on learning styles. Finding and results were discussed based on related works. An interview is another way of collecting information by choosing sample people and making them interact with the researcher. Three different nationality experts were selected and interviewed to give their opinion about the results as kind of validation to the study. The researcher met the experts over the telephone and asked them questions regarding the research's subject and results. This is because an interview is considered a good resource of information that can support the research. After that, a conclusion and recommendation were written to extend this study in the future further.

Ethical Consideration

- Participant's permission was requested from the learner before the experiment is commenced; everything is voluntary.
- Their privacy and personal data were protected.
- We made sure that the experiment was not harmful to participants.

Limitation of the Study

Limitations of this study are:

- This research will be conducted with very limited participants; the data collected would need more research; the result of this research is not expected to be generalized due to the limited number of participants.
- This research was conducted on adult participants of learning Penetration Testing who are older than eighteen years old; the result can't be generalized for younger learners.

RESULTS AND DISCUSSION

This section describes the interpretation of the finding from the analysis of the data collected in the previous section.

The goals of this research are:

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1. Explore students' learning style of using Penetration Testing tools.
2. Measure the relationship between VARK learning styles and using Penetration Testing tools.
3. Validate the results

Research questions

RQ1 - Which learning style do Penetration Testing students prefer most?
RQ2- Is there any relationship between learning style and performance?
RQ3- Is there any difference between males and females in learning styles?

Participants

Table 1: Participants show that the total of participants is 59 students. The sample was in two almost equal halves. The percentage of Male was 50.8%, and female was 49.2%. The minimum age of participants was 18 years old. The maximum age was 33 years old as shown in

Table 1: Participants

Gender	Frequency	Percent
Male	30	50.8
Female	29	49.2
	59	100

Table 2: Participants Age

Std. Deviation	Mean		Maximum	Minimum	N	
Statistic	Std. Error	Statistic	Statistic	Statistic	Statistic	
3.581	.466	21.93	33	18	59	Age
					59	Valid N (listwise)

A VARK Questionnaire is distributed to students. It contains 16 questions, there are four multiple-choice answers. Each answer represents one of the four learning styles of VARK. Maximum score of visual by participants was 7. The maximum score by aural participants was 8. Maximum score of reading/writing participants was 8. The maximum score of kinesthetic participants was 9 and the minimum was 3.

As shown in Table 3: VARK learning styles, visual learners' mean score equals 3.63 with a standard deviation of 1.72. The mean score of aural learners equals 3.61 with a standard deviation of 1.81. The mean score of Reading/Writing learners equals 3.64 with a standard deviation of 1.7. The largest mean was scored by kinesthetic students (5.10). The remaining indicators showed almost equal means with a standard deviation of 1.57.

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Table 3: VARK learning styles

Std. Deviation	Mean		Maximum	Minimum	N	
Statistic	Std. Error	Statistic	Statistic	Statistic	Statistic	
1.721	.224	3.63	7	0	59	Visual
1.810	.236	3.61	8	0	59	Aural
1.710	.223	3.64	8	0	59	Reading and writing
1.572	.205	5.10	9	3	59	Kinesthetic
					59	Valid N

Table 4:Using Penetration Testing tools

Std. Deviation	Mean		Maximum	Minimum	N	
Statistic	Std. Error	Statistic	Statistic	Statistic	Statistic	
11.370	1.480	69.83	95	50	59	(GUI)
10.182	1.326	66.53	90	50	59	(Programming)
11.225	1.461	64.15	90	50	59	(CLI)
12.190	1.587	67.54	95	50	59	(WBA)
13.047	1.699	69.32	95	50	59	Participation
					59	Valid N (listwise)

Penetration Testing instructors examined their students in four skills ((GUI), (Programming), (CLI) (WBA),) in addition to (participation).

T-Test:

In this research, t-test was used to detect a difference between the means of two dependents variables

Table 5: VARK learning styles and gender

Std. Error Mean	Std. Deviation	Mean	N	Gender	
.302	1.655	3.47	30	Male	Visual
.334	1.800	3.79	29	Female	
.352	1.925	3.50	30	Male	Aural
.317	1.709	3.72	29	Female	
.310	1.695	3.43	30	Male	Reading and writing
.321	1.726	3.86	29	Female	
.310	1.695	5.57	30	Male	Kinesthetic
.240	1.293	4.62	29	Female	

As shown in Table 5: VARK learning styles and gender, The mean between male and female are almost the same,

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results showed the insignificant difference between male and female who were Kinesthetic.

Table 6: Penetration Testing skills and gender

Std. Error Mean	Std. Deviation	Mean	N	Gender	
1.815	9.944	64.50	30	Male	(GUI)
1.889	10.171	75.34	29	Female	
1.723	9.440	62.83	30	Male	(Programming)
1.788	9.630	70.34	29	Female	
1.372	7.512	57.33	30	Male	(CLI)
1.868	10.058	71.21	29	Female	
1.433	7.849	60.67	30	Male	(WBA)
2.205	11.872	74.66	29	Female	
1.638	8.972	62.17	30	Male	Participation
2.331	12.555	76.72	29	Female	

Results showed that females' mean scores were higher than males in all four skills and in participation in the classroom, as shown in Table 6: Penetration Testing skills and gender.

Testing Research hypotheses

RQ3 - Is there any difference between males and females in learning styles?

Vark learning styles

The independent sample t-test is used to test the difference between VARK learning styles through gender (male/female),

From the p-value of Visual learning style, the null hypothesis will be accepted under 95% confidence level because p value equal 0.47 which is greater than α 0.05; which means there is no significant difference between Visual scores between male and female.

Table 7: VARK t-test

	F	P-value of F	T	P-value of T
Visual	0.04	0.83	-0.72	0.47
Aural	0.532	0.46	-0.47	0.63
Read and write	0.00	0.946	-0.962	0.34
Kinesthetic	1.91	0.17	2.41	0.02

It worth to be mentioned that Kinesthetic learning styles showed a significant difference with gender as shown in the p-value of t (0.02) which is less than α 0.05 as shown in Table 7: VARK t-test.

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Skills of Penetration Testing

Table 8: Penetration Testing skills t-test

Skills	F	P-value of F	T	P-value of T
(GUI)	0.22	0.639	-4.14	0.000
(Programming)	0.33	0.568	-3.02	0.004
(CLI)	1.98	0.165	-6.01	0.000
(WBA)	7.25	0.009	-5.32	0.000
Participation	6.60	0.013	-5.10	0.000

There is a significant difference between male and female learners, as shown in the p-value of t. female showed better scores in the mean as shown in Table 6: Penetration Testing skills and gender and in Table 8: Penetration Testing skills t-test

Table 9: Visual LS VS learning language skills

Participation	(WBA)	(CLI)	(Programming)	(GUI)	Visual		
.288(*)	.256	.372(**)	.328(*)	.305(*)	1	Pearson Correlation	Visual
.027	.051	.004	.011	.019		Sig. (2-tailed)	
59	59	59	59	59	59	N	

According to the p-value of Pearson correlation p-value 0.019, there is a significant correlation between visual learning styles and (GUI) skill, under 95% confidence level.

There is a strong relationship between the student who was "Visual" and the skill of "(GUI)" p-value =0.019. It also showed a significant relationship between students who were Visual and the skill of "(Programming) "p-value=0.11. It shows that there is a significant relationship between the visual student and the skill (CLI) p-value=0.004. Also, there was a significant relationship between a student who was visual and being active "classroom participation" p-value=0.027. There is no significant relationship between a student who was visual and the skill (WBA) p-value=0.051. That means: it is good for students to be visual in learning English as shown in Table 9: Visual LS VS learning language skills.

VARK Correlations with Skills of Penetration Testing

Table 10: Aural LS VS Penetration Testing skills

Participation	(WBA)	(CLI)	(Programming)	(GUI)	Aural		
-.033	.022	-.034	.033	-.037	1	Pearson Correlation	Aural
.802	.867	.801	.805	.782		Sig. (2-tailed)	
59	59	59	59	59	59	N	

There is no significant relationship between "Aural" and all the tested skills. As shown in Table 10: Aural LS VS Penetration Testing skills.

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Table 11: Reading and writing LS VS Penetration Testing skills

Participation	(WBA)	(CLI)	(Programming)	(GUI)	Reading and writing		
-.034	.057	.033	-.062	-.025	1	Pearson Correlation	Reading and writing
.797	.670	.802	.639	.849		Sig. (2-tailed)	
59	59	59	59	59	59	N	

There is no significant relationship between "Read and Write" and all the skills. As shown in Table 11: Reading and writing LS VS Penetration Testing skills

Table 12: kinesthetic vs Penetration Testing skills

Participation	(WBA)	(CLI)	(Programming)	(GUI)	Kinesthetic		
-.224	-.351(**)	-.391(**)	-.311(*)	-.245	1	Pearson Correlation	Kinesthetic
.089	.006	.002	.016	.062		Sig. (2-tailed)	
59	59	59	59	59	59	N	

There is a significant negative correlation between Kinesthetic and (Programming), (CLI), (WBA) as shown in Table 12: kinesthetic vs Penetration Testing skills

Summary of students results

RQ1 - Which learning style do Penetration Testing students prefer most?

Based on the above statistics, visual learning style is the most preferred style by Penetration Testing students, than kinesthetic learning style, while Aural and reading and writing are the least preferred styles.

RQ2- Is there any relationship between learning style and performance?

There are a significant relationship between Visual learning style and the Penetration testing skills of (GUI) and (Programming), (CLI), (WBA) and participation, while other styles did not show any effect on penetration skills.

RQ3- Is there any difference between males and females on learning styles?

There were no significant differences between gender and learning styles. Kinesthetic shows some differences between males and females, but it is not significant. We found some differences between boys and girls in a classroom.

Summary of validation interviews

After getting the results of the questionnaire, the experts were interviewed. The goal of the interview was to validate the results and to check if they were accurate. The experts were asked five questions. Those questions are:

1. What is your opinion about the results of the research?

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2. Are the results of the research beneficial in Penetration Testing learning?
3. How important (VARK learning styles) in the field of teaching Penetration Testing?
4. Is there anything you believe worth to be mentioned?
5. What is the question that you would ask an expert about these results?

The experts answered the questions by seeing that the researcher put a lot of effort into proving his points. The minute detailing in data presented shows the pain an interest he has taken to prove his VARK learning style effect on penetration testing. According to the yardstick adopted for research, literature review, questionnaire, and interviews prove that the research results are commendable. The second Expert said: The results of this study revealed a relationship between the variables of learning styles and the students' academic performance. The third Expert said: The painstaking work the researcher has put in proving his arguments is evident in the much-detailed data processing he has done, as regards VARK learning style. The yardstick he has adopted in researching, literature reviewing, and interviewing all goes to show for the commendable results he has reached.

The results were beneficial in Penetration Testing learning. It gives a proper idea about the impact it leaves on the students in general and specifically on boys and girls separately. It will help the teacher keep in mind which method of teaching will be beneficial for girls and boys and accordingly they can prepare their lecturers. Although there is not much difference shown in kinetics approach, which has a slight bend towards boys, this research will reflect better penetration testing learning results. The second Expert said: It is beneficial because the researcher aims to explore students' learning style of learning to facilitate teaching penetration testing. Third Expert said: The results reached definitely reflect the impact it has on students as a whole and on boys and girls each, which would help find out what method of teaching is best for them. Although there is no significant difference except in the kinetics approach slightly favoring boys, the research still shows better Penetration testing learning results.

If you go through the result summary, you can say that VARK style of teaching is effective, all aspect of it focuses skills learning especially visual. All other also equally important but visual is considered the best according to the research. The second Expert said: The significance of VARK learning styles in the field of teaching and training stems from the classification of the students to four different modes. This process enables the teachers to observe the efficiency and validity of each lesson. Third Expert said: The summary of results is evidence of the effectiveness of VARK learning style. The aspects of his style, especially the visual one, focus on skills learning and although the other aspects are equally so, the visual aspect is the best.

The research done on the subject is complete in itself as the main focus on VARK for teaching Penetration Testing is properly described and well-illustrated with the data's help.

I feel that the teacher should understand the usage of the VARK learning style it benefits and shortcomings, as this tool is in the hands of the teacher, he can only handle it to perfection. The second Expert said: To reach the validity of this study, some experts should be questioned to give objective comments about the study's instruments. The third Expert said: The research in itself is complete since it mainly focuses on VARK style, which is done well together with the complete illustration of data, but I suggest that the researcher pay more heed to the use of VARK style, its merits, and demerits, and since the tools of which are there for the teacher he can put them to best use.

I want to ask an expert how we can make the least preferred styles of VARK more effective, as according to research Aural and reading, and writing are the least preferred styles. However, they are correlated to visual and kinesthetic styles. The second Expert said: Based on the study results, which teaching method do teachers prefer, why?. The third Expert said: Considering the preferred style for the research is the visual one, I would ask the Expert about

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how we could make the least preferred styles—the aural, reading, and writing ones—more effective, though they are also related to the visual and kinesthetic styles.

Conclusion and recommendations

Table 1: Participants show that the total of participants is 59 students. The sample was in two almost equal halves. Males were 50.8%, and females were 49.2%. The minimum age of participants was 18 years old. The maximum age was 33 years old. A VARK Questionnaire was distributed to students. It contains 16 questions; there are four multiple-choice answers. Each answer represents one of the four learning styles of VARK Penetration Testing instructors examined their students in four skills ((GUI), (Programming), (CLI) (WBA),) in addition to participation. The mean between males and females is almost the same, as a result, shows an insignificant difference between males and females who were Kinesthetic. Results showed that females' mean scores were higher than males in all four skills and in participation in the classroom.

The independent sample t-test is used to test the difference between VARK learning styles through gender; there is no significant difference between Visual scores between males and females. It is worth mentioning that Kinesthetic learning styles showed a significant difference with gender, as shown in the p-value of t (0.02), which is less than α 0.05. There is a significant difference between male and female learners, as shown in the p-value of t. female showed better scores in the mean in Table 6: Penetration Testing skills and gender. According to the p-value of Pearson correlation p-value 0.019, there is a significant correlation between visual learning styles and (GUI) skill, under 95% confidence level. There is a strong relationship between a student who were "Visual" and the skill of "(GUI), (CLI) and being active "classroom participation". There is no significant relationship between a visual student and the skill (WBA). That means: it is good for students to be visual in learning penetration testing. There is no significant relationship between "Aural" and all the tested skills. There is no significant relationship between "Read and Write" and all the skills. There is a significant negative correlation between Kinesthetic and (Programming), (CLI), (WBA). The researcher recommends considering students' learning styles when teaching them Penetration Testing as every individual student learns differently.

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