Prevalent beliefs in learning styles myths: Indonesian research trends on learning styles

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This study investigates Indonesian research trends on learning styles and searches for evidence verifying or refuting the learning styles matching hypothesis. This hypothesis, considered a myth in learning styles theory by some scholars, claims that a learner will learn better when taught according to his or her learning style, but there has been no strong empirical evidence to support it. We also attempted to analyse researchers' judgments concerning the matching hypothesis by identifying epistemic modality markers in the manuscripts. The data were research articles written in English by Indonesian authors that have been published in journals indexed by Google Scholar, Scopus, or Web of Science. After sifting through abundant research articles discussing learning styles, we obtained 33 articles that matched the criteria of this study. Based on the data analysis, we discovered the 33 articles comprised 19 descriptive studies, 2 correlational studies, 9 causal-comparative studies, and 3 experimental studies. In addition, we found that only one piece of evidence refuted the matching hypothesis, while the majority showed that the researchers were likely to believe in the matching hypothesis.

Introduction

The influence of learning styles in the education field has been widespread since it was introduced. The concept of this theory is highly convincing among educators, teachers, researchers, students, and even parents. It underlines the idea that every individual has his or her particular style in learning, organising, and processing information for further use, then classifies each of them into a different category based on learning preferences (Jaleel & Thomas, 2019). One of the most popular learning style theories is Fleming and Mills' (1992) *VARK model* (visual, aural, read/write, kinesthetic). This model suggests that visual learners will achieve better by seeing, aural learners benefit by hearing information, reading/writing learners learn best by reading information from printed words, and kinesthetic learners tend to learn best by doing.

Besides grouping learners differently, all learning style ideas rest on another fundamental claim, that each learner acquires information better when it is presented according to his or her learning style. In other words, teaching according to the individual's learning styles will make them learn more effectively and less effectively otherwise. Hamdan and Aldossari (2021) stated that teachers should encourage students to become aware of their learning styles so that they could enhance their learning. This concept is then called the *meshing hypothesis* (Pashler et al., 2009) or *matching hypothesis* (Cuevas, 2015). This prominent hypothesis led to the emergence of an abundance of business offers devoted to learning

styles such as tests, guidebooks, and professional development workshops for teachers and educators. Moreover, test instruments have been developed, published, and sold to help schools or teachers to identify and classify students into different style categories (e.g., Fleming & Bonwell, 2019). Besides, it has led many researchers to investigate the learning styles of higher education students (e.g., Stander et al., 2019) and the relationship between learning styles and other variables such as students' emotional intelligence (e.g., Estrada et al., 2019) or community of inquiry (e.g., Sidiropoulou & Mavroidis, 2019). The ultimate goal of these endeavours is to build a concept of how to create a teaching method, which aligns with students' styles.

Despite its popularity, some scholars consider the learning styles-matching hypothesis as a myth since there was no empirical evidence to support the idea that presenting instructional materials in a way that matches students' learning styles could help students improve their learning (Rogowsky et al., 2020; Nancekivell et al., 2019; LeBlank, 2018; Newton & Miah, 2017; Rogowsky et al., 2015; Riener & Willingham, 2010; Pashler et al., 2009). Pashler et al. (2009) clarified that evidence should be an experimental study in which a researcher classifies students based on their learning styles, randomly assigns students to a particular learning/teaching method, gives an intervention in teaching by using the method, and administers the same test for all students. Following their model of evidence, Cuevas (2015), for instance, analysed 31 research articles to find evidence for the matching hypothesis. He found that most of the reviewed articles refuted the matching hypothesis in which the learning style-based instruction could not help students enhance their achievement or there was no correlation between students' achievement and their learning styles. He also discovered that some articles were not credible enough to be a piece of evidence due to some inappropriate procedures in the research method. Cuevas' (2015) research findings disclosed a new perspective for us to reconsider what we have known about learning style all this time. Although sometimes it is hard to accept or even change what we have already believed, whether we like it or not, we have to ponder a contrasting finding that has been proven empirically.

Among many empirical studies to test the matching hypothesis, some studies failed to support the matching hypothesis. For instance, Toyama and Yamazaki (2020) investigated the effect of matched learning-teaching styles instruction on the student's proficiency and motivation to learn English. The result indicated that both groups (match and mismatch groups) significantly affected the students' proficiency and motivation. Similarly, Aslaksen and Lorås (2019) discovered that there was no significant difference between matching and mismatching instruction on students' immediate recall and working memory performance when given a working memory test with visual and auditory stimuli.

Furthermore, the effect of student-teacher match instruction showed no significant result for adult learners (Rogowsky et al., 2015) and for young learners. Rogowsky et al. (2020) purposively selected fifth graders (ages 10-11) in a public middle school in a rural area in Pennsylvania, USA, and randomly assigned them into two experimental groups taught using different instructional methods (audiobook for auditory learners or e-text for visual learners). They were then given a verbal comprehension aptitude test in both oral and written forms. The results showed that visual learners achieved better listening and

reading comprehension than auditory learners. Similar to Aslaksen and Lorås (2019) and Toyama and Yamazaki (2020), the findings from Rogowsky et al.'s (2020) study also clearly refuted the matching hypothesis claiming that visual learners will only score higher in reading comprehension and that auditory learners will only achieve listening comprehension better than their counterparts with a different learning style.

On the other hand, a study by Amaniyan et al. (2020) supported the matching hypothesis, revealing that teaching using a concept map significantly enhanced visual learners' achievement in the experimental group, compared to other visual learners in the control group. Conversely, the concept map did not promote other learners (auditory, writing/reading, and kinesthetic learners) in both experimental and control groups. Although this study used a more rigorous true experimental design, it did not compare the groups (visual, auditory, writing/reading, and kinesthetic groups) in the experimental group; therefore, we were unsure whether the concept map affected only the visual learners. Besides, it was in contradiction with two previous studies that implemented a similar teaching method (e.g., Mosley, 2013) which uncovered no significant change in students' achievement across learning styles in either the control or experimental groups. Therefore, the finding was open to debate and scrutiny because other students with different learning contexts might show different results concerning the effect of a concept map on their achievement.

In addition to those controversies, believing in the matching hypothesis might be harmful to both educators and students. Riener and Willingham (2010) suggested three reasons for this claim. Firstly, it evokes educators' ignorance (e.g., teachers and researchers) on the research from which there is no scientific support. Therefore, it is not surprising to discover that some research investigated the effect of the hypothesis on students' achievement but with no proper methods. Secondly, the belief in the matching hypothesis prevents students accepting teachers' teaching styles or media that differ from their learning styles. For instance, a student might think that he or she is a visual learner, so the best way to learn in the classroom is through the visual teaching style or media. Consequently, he or she eventually disengages when a teacher explains a concept by telling a story because listening to the narrative does not suit his or her learning style. Thirdly, a particular teaching style or media is appropriate for presenting certain content instead of the student's learning style. For example, most students may find it difficult to understand the concept of metamorphosis in biology by only listening to the teachers' explanation without visualising or observing the object. In this case, teaching using visualisation or observation will help the students learn the content better without considering the student's learning preferences. This, however, does not mean that learning styles should be neglected entirely, since it is necessary when studying independently (LeBlank, 2018). Being aware of the learning style helps students design their learning strategies to enable more effective learning without overriding other preferences.

Nevertheless, the learning style-matching hypothesis continues to gain wide acceptance among teachers, although only a few of them truly administer it in the classroom. For example, Newton and Miah (2017) investigated whether academics in UK higher education believed in the existence of learning styles and used them as a presumption in

designing curriculum or classroom instruction. They discovered that the majority (95%) of teachers were confident that students would achieve better when taught in their preferred learning style. However, some of them (33%) stated that they just used the learning style as their teaching method in the last 12 months. In the American context, Nancekivell et al. (2019) found that strong believers were more likely to view that the learning styles were inherited from birth, stored in the brain, able and to predict school learning and career outcomes. Conversely, others perceived that the learning styles were shaped and changed due to experimental factors.

In light of the matching hypothesis as a myth in learning styles, we aimed at investigating whether it is prevalent in Indonesia by examining research trends on learning styles in the Indonesian context. It also went further to evaluate how learning styles were presented in the studies, whether the researchers persistently believed in the matching hypothesis, and whether a gap remained between the research on the subject and its acceptance in practice. We set out the following research questions:

1. What are the research trends on the learning style matching hypothesis in Indonesia?
2. Is there any evidence supporting or opposing the learning style matching hypothesis?
3. What is the researchers' judgment toward the learning style matching hypothesis?

Methods

To investigate Indonesian research trends on learning styles, find evidence, and analyse researchers' judgment toward the learning style matching hypothesis, we reviewed the most recently published articles by Indonesian writers. This reviewing process was then classified as a semi-systematic literature review (Snyder, 2019) or a meta-narrative review (Wong et al., 2013) which intended to analyse and synthesise patterns in the form of themes, theoretical perspectives, or common issues within a specific research discipline. The process of conducting the literature review follows four phases: (1) designing the review; (2) conducting the review; (3) analysing; and (4) writing the review.

Corpus selection

We initially selected research articles written in English by Indonesian researchers in the Lens database (https://www.lens.org/). Those articles should have the term "learning style" as a keyword in their title. Most importantly, they were published in journals indexed in *Google Scholar* (https://scholar.google.com), in *Scopus* (Elsevier's abstract and citation database, https://www.scopus.com/), or *Web of Science* (an abstract and citation database at https://clarivate.com/webofsciencegroup/solutions/web-of-science/, maintained by Clarivate Analytics). Those journals were considered reputable journals since they applied a strict requirement to be indexed in those databases. After sifting through those journals, we found 33 empirical articles that met the criteria of this study and 28 of which belonged to journals indexed in Google Scholar, four articles in Scopus, and one article in Web of Science. Those journals covered such disciplines as education, English language teaching, science, and technology.

Data analysis

The data were analysed in two steps. The first step was to know the Indonesian research trends on learning styles by reviewing and grouping them into types. Then we searched for evidence that supported or refuted the learning styles matching hypothesis referring to Pashler et al.'s (2009) model of evidence. The evidence should be an experimental study in which the researchers applied learning styles-based instruction and tested its effect on the student's achievement. It was considered acceptable or unacceptable evidence if it followed several criteria:

(1) The researcher(s) classified the students as having a particular learning style (e.g., visual, aural, read/write, and kinesthetic);
(2) The researcher(s) randomly assigned every student to a teaching method group;
(3) All students took the same test;
(4) The matching hypothesis is verified only if the result showed that a teaching method optimised a group of students more than the other groups as shown in Figure 1 (e.g., teaching using video only improves visual learners' achievement);
(5) By contrast, the matching hypothesis is not verified if the result showed that the same teaching method also optimised the other group as in shown Figure 2 (e.g., teaching using video not only improves visual learners' achievement, but it also improves aural learners' achievement).
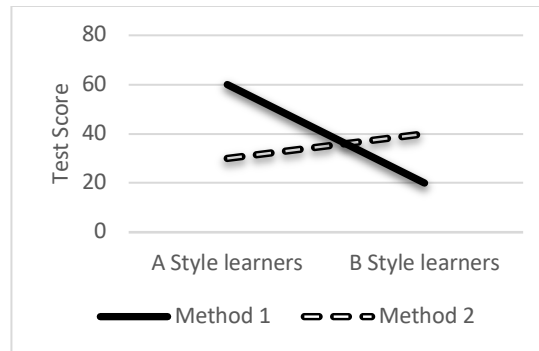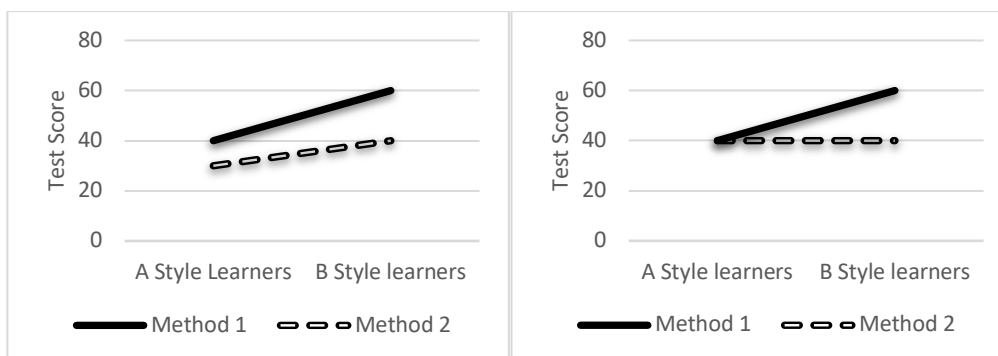

Figure 1: Acceptable evidence

Figure 2: Unacceptable evidence

The second step was to investigate the researchers' judgment toward the matching hypothesis. Their judgment was reflected in their choice of epistemic modality markers in the manuscript. Nuyts (2001) defined epistemic modality as lexical and grammatical expressions that signify researchers' evaluation of the likelihood that a certain proposition has occurred or will occur. It included modal verbs, modal adverbs, adjectives, and nouns as illustrated in Table 1.

Table 1: Epistemic modality

Form	Epistemic certainty	Epistemic probability	Epistemic possibility
Modal	*must, will*	*should, ought to*	*can, could, may, might*
Modal adjunct	*certainly, definitely, surely*	*probably, perhaps, maybe*	*possibly, perhaps, maybe*
Lexical verbs	*believe, guarantee*	*guess, think, suppose*	*guess, wonder, think, suppose*
Lexico-modal auxiliaries	*be certain to, be bound to, be sure to*		
Clause with adjective		*likely, probable*	*possible*
Clause with past participle	*confirmed* that		*allowed*
Clause with noun	There is *certainty* that	There is *likelihood/ probability*	There is a *possibility* that
Conditional clause	*If* a condition is fulfilled it is certain that another condition *will* take place	*If* a condition is fulfilled it is probable that another condition *will* take place.	*If* a condition is fulfilled it is possible that another condition *will* take place.
Combination of modal and adjunct	*will definitely, must certainly*	*Will probably, perhaps … would*	*Might possibly*

Initially, the research articles which were presented in .pdf format were converted to .txt files using *AntFileConverter*. Then we excluded any peripheral segments such as titles, headings, captions, footnotes, tables, charts/figures, appendices, and references. Then, the epistemic modality markers were identified using *AntConc* in the introduction and conclusion sections of the research articles. Those two sections constituted the overall contents of the manuscripts in which the authorial stance seems to be most clearly visible (Adams & Toledo, 2013). That is, the introduction establishes the significance of the study by presenting the researchers' argument while the conclusion evaluates and generalises the findings and the discussion.

Findings

Indonesian research trends on learning styles

One interesting fact about the selected articles was that most of the researchers utilised VAK/VARK as their framework to classify students' learning styles and their research designs were mostly descriptive research. They did not test the matching hypothesis, but

merely analysed students' learning styles with no further implication while the others correlated the results with the other variable (i.e., students' achievement or existing teaching technique). In this section, we briefly summarise each research study's objective and its main finding to see any similarities or differences among them that could help us better understand how the learning style matching hypothesis was presented in those studies.

Descriptive research
As illustrated in Table 2, 19 out of 33 research articles used descriptive design. Those studies mostly aimed at analysing students' learning styles based on a learning style inventory result. They simply distributed a questionnaire to determine students' learning styles and presented the result in terms of percentages. Besides, there were two literature review studies discussing the pros and cons of learning styles (Rinekso, 2020) and the concepts (Silitonga et al., 2020), and one study integrating a particular approach in learning style identification (Sahid et al., 2017).

Table 2: List of research articles using descriptive design

No	Researcher(s)	Research subjects	Learning styles inventory	Research objective
1	Hermini, et al. (2021)	Higher education students	VAK learning styles	Investigating students' learning styles
2	Patintingan (2021)	Higher education students	VAK learning styles	Investigating students' learning styles
3	Manipuspika (2020)	Higher education students	VAK learning styles	Investigating students' learning styles
4	Muluk et al. (2020)	Higher education students	VAK learning styles	Investigating students' perception of learning styles
5	Putri & Suryati (2020)	Higher education students	VAK learning styles	Investigating students' learning styles
6	Wahyudin & Rido (2020)	Higher education students	VAK learning styles	Investigating learning styles of Indonesian, Libyan, and Iranian students
7	Rinekso (2020)	-	Any type of learning styles	Describing 8 research articles from 1982-2018 discussing the pros and/or cons of learning styles
8	Silitonga et al. (2020)	-	VAK learning styles	Describing the concept of learning styles
9	Wahab & Nuraeni (2020)	Higher education students	VAK learning styles	Investigating students' learning styles
10	Kulsum & Kristayulita (2019)	Higher education students	VARK learning styles	Analysing students' problem solving across learning styles
11	Hijrah et al. (2019)	Higher education students	VAK learning styles	Investigating students' learning styles across gender
12	Lailiyah (2019)	K-12 students	VAK learning styles	Clustering students' learning styles
13	Sunggingwati & Haviluddin (2019)	Higher education students	Kolb learning styles	Investigating students' learning styles

14	Widayanti & Wiyasa (2019)	Higher education students	VARK learning styles	Investigating students' learning styles
15	Wulandari, (2019)	Higher education students	VARK learning styles	Investigating students' learning styles in the listening course
16	Arsyad (2018)	K-12 students	VAK learning styles	Investigating students' learning styles
17	Kurniati et al. (2018)	K-12 students	VAK learning styles	Investigating teaching media used by the teacher to match students' learning styles
18	Sahid et al. (2017)	-	VARK learning styles	Integrating stochastic and literate based driven approaches in learning style identification for personalised e-learning purposes
19	Tyas (2017)	Higher education students	VAK learning styles	Investigating students' learning styles across gender

Correlational research

There were two correlational studies investigating the relationship between students' learning styles and other variables as presented in Table 3.

Table 3: List of research articles using a correlational design

No	Researcher(s)	Research subjects	Learning styles inventory	Research objective
1	Triyanto & Handayani (2018)	Higher education students	Vermunt learning styles	Investigating the correlation between learning styles and motivation of natural and social science students
2	Ginting (2017)	Higher education students	VARK learning styles	Investigating the correlation between students' learning and thinking styles

Causal comparative

Table 4 showed nine causal-comparative studies involving inferential statistics to see if the students' learning styles affected the dependent variable without doing an intervention.

Table 4: List of research articles using a causal-comparative design

No	Researcher(s)	Research subjects	Learning styles inventory	Research objective
1	Albeta et al. (2021)	Higher education students	VAK learning styles	Investigating the effect of learning style on students' learning performance during the Covid-19 pandemic
2	Anggoro et al. (2019)	Higher education students	VAK learning styles	Investigating the effect of learning styles, maths disposition, and maths anxiety on students' metacognitive reconstruction in a maths course.

3	Bakri (2019)	K-12 students	VAK learning styles	Investigating the effect of learning style on students' English speaking skills
4	Barokah et al. (2019)	K-12 students	VAK learning styles	Investigating the effect of learning style on students' thematic learning achievement
5	Febriantina et al. (2019)	Higher education students	VAK learning styles	Investigating the effect of learning style and problem-based learning model on students' achievement
6	Marzulina et al. (2019)	Higher education students	VAK learning styles	Investigating the effect of learning style on students' English skills
7	Samsudin & Hardini (2018).	Higher education students	VAK learning styles	Investigating the effect of learning style and metacognitive skills on students' critical thinking
8	Suaib (2017)	K-12 students	VAK learning styles	Investigating the effect of learning style on students' English vocabulary improvement
9	Yasin et al. (2020)	K-12 students	SAVI (somatic, auditory, visual, intellectual) learning styles	Investigating the effect of Novick's learning and SAVI learning model on students' mathematical reasoning ability

Experimental research

Within our search, we found three quasi-experimental studies (as shown in Table 5), which could be evidence of the matching hypothesis.

Table 5: List of research articles using experimental design

No	Researcher(s)	Research subjects	Learning styles inventory	Research objective
1	Rigusti et al. (2020)	K-12 students	VAK learning styles	Investigating effect of problem-based and scientific learning models on students' self-esteem and maths problem-solving abilities across learning styles
2	Yudha (2019)	K-12 students	VAK learning styles	Investigating the effect of RME and scientific learning model on students' mathematical reasoning abilities across learning styles
3	Ningrum et al. (2016)	Higher education students	VAK learning styles	Investigating the effect of mind mapping on EFL students' idea development in argumentative writing across gender and learning styles

Evidence for the matching hypothesis

To be evidence for the matching hypothesis, a research article should be an experimental study testing the effect of teaching instruction on students' achievement across learning

styles. Although we found three experimental studies involving students' learning styles as the independent variables, only the study conducted by Ningrum et al. (2016) met the criteria specified in Pashler et al.'s (2009) model of evidence. The two other studies were not included as evidence because the teaching instructions seemingly did not match any of the students' VAK learning styles. For example, Rigusti et al. (2020) compared the effect of problem-based and scientific on the mathematical problem-solving ability of students with different learning styles. In this case, we could not decide which teaching method corresponded to each student's learning style.

Ningrum et al. (2016) investigated the efficacy of mind mapping on the idea development of EFL students' across learning styles when writing an argumentative essay. She found that the experimental and control groups were not significantly different from each other and the mind mapping did not influence the idea development of students across their learning styles. In other words, this result, which refutes the learning styles-matching hypothesis, claims that using mind mapping teaching strategy could promote visual learners' achievement.

Frequency of epistemic modality to indicate researchers' judgment

Researchers' judgment was designated by identifying epistemic modality markers in the manuscripts. This epistemic modality also signified the degree to what extent the researchers believed in the learning styles matching hypothesis.

Table 6: Overall frequency of epistemic modality

No	Epistemic certainty	Token	Taken	Epistemic probability	Token	Taken	Epistemic possibility	Token	Taken
1	Must	51	7	Should	62	12	Can	294	30
2	Will	164	16	Ought to	1	0	Could	33	3
3	Certainly	3	0	Probably	2	0	May	68	3
4	Definitely	0	0	Guess	0	0	Might	24	0
5	Surely	1	0	Think	29	0	Possibly	0	0
6	Believe	4	0	Likely	7	1	Perhaps	2	0
7	Guarantee	0	0	Probable	0	0	Maybe	0	0
8	Certain	26	0	Likelihood	0	0	Wonder	0	0
9	Bound	1	0	Probability	2	0	Suppose	1	0
10	Sure	1	0	If (probable)	0	0	Possible	16	0
11	Confirmed	4	0				Allowed	0	0
12	Confirm	2	0				Allow	5	0
13	Certainty	0	0				Possibility	1	0
14	If (certainty)	44	6				If (possible)	10	2
	Total	309	29		103	13		454	38
		32.1%			11.0%			48.4%	

As presented in Table 6, the total tokens of 38 epistemic modality markers in both the introduction and conclusion sections were 938 words consisting of 309 (32.1%) epistemic

certainty, 103 (11.0%) epistemic probability, and 454 (48.4%) epistemic possibility. However, only 80 (8.5%) excerpts belonged to the category in this study.

After indicating all epistemic modality markers, we carefully read the corpora to select or exclude the sentence according to the context of this study. For instance, we included excerpts (1), (3), and (5) because the researchers indicated their viewpoints of the matching hypothesis and we excluded excerpts (2), (4), and (6) because they did not belong to the category of this study.

> Excerpt 1: With these learning styles differences, educators must accommodate the needs of participants in the learning process activities. (*epistemic certainty* - Research article 25)
>
> Excerpt 2: In this research, the participants must respond to the questionnaire based on five points in Likert scale. (*epistemic certainty* - Research article 15)
>
> Excerpt 3: So that the lecturer should know the students' learning style and guide the students to choose an appropriate style in learning listening skill. (*epistemic probability* - Research article 20)
>
> Excerpt 4: There should be more complete research investigating other English skills such as reading, writing, and speaking. (*epistemic probability* - Research article 1)
>
> Excerpt 5: Meanwhile, knowing learning style for teacher can contribute to choose the best method in teaching and learning process. Of course it can boost the learning activity in the classroom. (*epistemic possibility* - Research article 14)
>
> Excerpt 6: There were some suggestions that the researcher can propose after doing the analysis as follow. (*epistemic possibility* - Research article 7)

Afterward, we summarised the researchers' judgments toward the matching hypothesis into four categories. They believed that: (1) Teachers should match teaching and learning styles to help them design effective teaching; (2) Teachers should match teaching and learning styles to help students learn better; (3) Teachers should consider and remind students about their learning style; and (4) Students should know their learning style to help them learn better.

Discussion

Although the learning styles-matching hypothesis has received much criticism among researchers due to the absence of strong empirical evidence to support it, the common trends of Indonesian research on learning styles were descriptive, correlational, and causal-comparative, without any instructional intervention to test the hypothesis. Those studies simply attempted to investigate students' learning styles in certain schools and universities, then correlated them with the other variables (e.g., student achievement, critical thinking, problem-solving, and reasoning ability) or compared them based on the other variables

(e.g., gender, nationality, and cohort). Hence, they were not considered as evidence because none of them was designed in such a way that they could test the matching hypothesis. This acceptable evidence should be any study that tested a learning styles-based instruction (e.g., mind map) to see if it succeeded or failed to enhance the independent variable (e.g., English achievement) of a particular learner (e.g., a visual learner).

We only found three experimental studies that did not aim to test the matching hypothesis, as the researchers simply investigated the effect of a particular teaching instruction on students' achievement. Then they checked if students' achievements were significantly different from each other across learning styles. In brief, there has been no study conducted in the Indonesian context recently (2016-2021) attempting to contribute to the matching hypothesis debate, except the one conducted by Rinekso (2020) who presented a literature review on the pros and cons of the learning styles matching hypothesis. Notwithstanding, a study by Ningrum et al. (2016) was the only one classified as a piece of evidence because it satisfied the criteria of an appropriate method according to Pashler et al.'s (2009) model, although she did not group the students based on their learnings styles before doing experimentation. They compared the effect of mind mapping with conventional teaching methods on students' idea development and discovered that the students with different gender and learning styles scored similarly in both teaching methods. This finding, then, was classified as unacceptable evidence opposing the matching hypothesis in which a teaching method promoted two or more students with different learning styles.

This finding was consistent with a previous study (Ceuvas, 2015) which also discovered that the vast majority of the research articles on learning styles have been those surveying students' learning styles and sometimes correlating the result with other variables, and the evidence tended to oppose the matching hypothesis. Although none of them admittedly implemented an instruction that matched students' learning styles, our analysis of epistemic modality markers in the research articles indicated that most researchers believed in the matching hypothesis. They tended to believe that learning styles contributed to students' better learning where teachers should match their teaching instruction with students' learning styles to enhance students' achievement. Interestingly, however, most researchers used epistemic possibility words (the lowest value of probability) to express their opinion on the matching hypothesis. In other words, most of them were likely to be less confident in conveying their knowledge about the hypothesis in that they tended to be uncertain that the matching hypothesis was an absolute truth. This tendency was closely related to the fact that none of them admittedly implemented a teaching method to promote a group of learners with the same learning styles, because a classroom naturally consisted of students with various different learning styles.

Similar to the studies conducted by Newton and Miah (2017) in UK higher education and by Nancekivell et al. (2019) in the American context, the findings of the present study also revealed that the matching hypothesis has gained great acceptance among Indonesian researchers, although many empirical studies have recently refuted it. We argued two possibilities for this tendency; First, Indonesian researchers were not familiar with the

issue. Second, they were completely immersed in the common knowledge that the teacher should match their teaching method with the student's learning styles to promote their learning. Riener and Willingham (2010) believed that this common knowledge contributed to a confirmation bias, in which they tended to elicit any information that confirmed their beliefs and ignored contrary information, even when they encountered it many times. Educators, therefore, should encourage students to understand their strategies and abilities with an understanding that learning is multifaceted. Instead of assuring students that they can only learn better with one or two learning styles, students can be helped to learn more effectively in different ways by reflecting on different combinations of learning styles and abilities. In fact, learning styles-based instruction is rarely conducted, because naturally a classroom consists of various learners with different learning styles. It will be more beneficial to use an appropriate teaching method for the subject content and the level of students' prior knowledge, ability, aptitude, and interest.

Conclusion

The controversial issue concerning the learning styles-matching hypothesis led us to investigate Indonesian research trends on learning styles, search for evidence, and analyse the researchers' judgments toward the hypothesis by identifying epistemic modality markers in the manuscripts. One question that came up in our mind was whether or not Indonesian researchers believed in the hypothesis and realised that it has been debunked by now. After sifting through many research articles, we eventually obtained 33 research articles published in various journals indexed in Google Scholar, Scopus, or Web of Science. Our investigation resulted in discovering that the vast majority of research on learning styles comprised articles that did not test the matching hypothesis (e.g., descriptive, correlational, and causal-comparative studies). We found only one experimental study that matched Pashler et al.'s (2009) criteria to be evidence for the matching hypothesis, although it did not aim to test the hypothesis. This evidence revealed that all learners with VAK learning styles performed similarly when taught using a mind map teaching strategy, which refuted the matching hypothesis claiming that a mind map teaching strategy could favour visual learners. This result contributed to previous studies (e.g., Ceuvas, 2015; Pashler et al., 2009), which also revealed no empirical evidence to support the matching hypothesis.

We also assumed that the tendency of Indonesian researchers to not test the hypothesis was related to their beliefs toward it. Most of them probably believed that teachers should match their teaching strategy with students' learning styles (e.g., a mind map for visual learners). However, none of them admittedly applied this theory in their classroom. In other words, there has been a discrepancy between what the researchers believed was true and their practice in the field. One possible reason for this discrepancy is that teachers rarely employ the idea of presenting instructional material in a format that matches the student's learning styles because a classroom usually consists of students with different learning styles. The most common practice is to use a variety of teaching methods to accommodate diversity of students' learning styles (e.g., Hojeij & Baroudi, 2018).

Having been informed about the myth of learning styles in terms of the matching hypothesis in the literature, therefore, teachers and researchers should consider the following reasons why they should stop believing in the hypothesis.

(1) Students could learn from instructional materials in various formats (e.g., video, audio, etc.) although they do not match their learning styles because the brain stores different types of information in different areas of the brain and it is interconnected to process the information so that as soon as one modality is activated, others are too.
(2) Learning styles are not consistent attributes. What the students thought about their learning styles in the present day might be different from what they perceive in the future (Krätzig & Arbuthnott, 2006).
(3) There is no evidence supporting that the learning styles-matching hypothesis improves learning (Pashler et al., 2009).

Instead of putting much effort into investigating students' learning styles and finding teaching methods to match the student's learning styles, this finding encourages teachers or researchers to design a pedagogical approach by considering the students' different background knowledge, ability, and interests, but not their learning styles. Each student might have different styles of learning, but it was meaningless to find out the student's learning style as a presumption to construct a classroom instruction that matches their learning styles. This study, however, deals only with Indonesian research articles written in English, which restrict us from obtaining more articles; hence it becomes an area for further investigation. Besides, a corpus-based study using research articles as the data source to investigate whether people (e.g., researchers, teachers, students) persistently believe in the learning styles-matching hypothesis and how they perceive the hypothesis is still scarce, as many studies with a similar purpose have been conducted under qualitative research methods employing surveys, interviews, or questionnaires to collect the data. Nevertheless, our review method and findings from Indonesia may provide a valuable example for researchers in other country contexts.

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*** Asterisk indicates a selected research article**

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