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TEACHERS' PERCEPTIONS OF LANGUAGE FOSTERING IN THE CONTEXT OF PHYSICS TEACHING IN VIETNAM

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ABSTRACT

Many educational researchers and teachers have agreed that language can be fostered in the context of science teaching. However, the effect of language fostering has depended heavily on teacher's perception. Recognizing the role of teaching (including Physics teaching) in language training will help teachers become conscious while designing teaching activities, contributing to promoting cognitive activities of students. Therefore, the purpose of the study was to identify teachers' perceptions to foster language in the context of physics teaching in Northern Vietnam, where many ethnic minority students study for whom Vietnamese is like the second language. A survey was used to collect the data from 64 physics teachers who taught in high schools. The differences in teaching experience and education background of physics teachers toward languages fostering were examined by the independent sample t-test and the one-way ANOVA. The obtained results show that (i) most teachers held a positive view about the importance of language of physics in teaching (ii) There were no statistically significant differences in the importance of language in teaching physics based on the education background of teachers; (iii) The novice teachers held a more positive perception than the experienced ones about the importance and signs of language in the student's physics learning process. These results would prove to be a valuable source of information for designing physics teaching activities for language fostering in mountainous areas of Vietnam.

Contribution/Originality: This study contributes to the domain of teachers' perception to foster language in the context of physics teaching in mountainous areas of Vietnam. These findings are a useful contribution for researchers who are interested in language acquisition in different contexts and for educational leaders who are looking for reforms in general education.

1. INTRODUCTION

Henderson and Wellington (1998) assert that "In all parts of the curriculum, the quality of classroom language is bound up with the quality of learning" (p. 36). An idea that was not novel is that language has been an important role in learning any school subject. Language and reading literacy were fostered in the literature learning process and fostered in the context of science teaching (e.g. (Henderson & Wellington, 1998; Jimenez-Silva & Gómez, 2011; Wellington & Osborne, 2001)). PISA is an international assessment platform to measure young students' knowledge and skills in 3 domains: reading, mathematics, and science literacy; out of which reading is one of the major domains evaluated by PISA since 2000. Questions are asked by students about the use of language to decode and interpret pieces of information from various sources and encompass the range of situations in which people

read, and different ways written texts are presented (OECD, 2016). The results of PISA show that fostering of language in teaching science subjects is more meaningful and needs more attention.

Science education has proved to be a pathway to teaching language literacy where authors show the integrating of science instruction with literacy instruction (and vice versa) and highlight its successes as well as challenges (Tolbert, 2011). To foster language for learners, previous literature in western countries abounds in integrated content and language focused on additive bilingualism, i.e., second language learning added on to the mother tongue. Vietnam is a developing country, where bilingual classes are not common. There are, however, many ethnic minority students with their own communication and language characteristics, coming from economically weak and socially challenged regions (Trang et al., 2020).

The Vietnamese language of the ethnic minority students had developed from different sources and associated with their living environment and communication. It was not uniform with all speakers of this language because of its complexities. Researches have stated that ethnic students frequently use their mother tongue to communicate , so when they have to use Vietnamese to study, they often commit errors of pronunciation, style, and context (e.g. (Gioi, 2011; Ha, 2012). In the context of Vietnam, language fostering is usually more supported by literature and foreign language learning (Gioi, 2011; Ha, 2012). A research gap however still existed in the field of language fostering for the learning of science subjects. To fill this gap, it is essential to find out the perspective of physics teachers who are directly involved in the teaching of physics to ethnic students. This was assisted by the overarching question guiding this study: What is the perception of teachers in the highlands about language fostering in the context of physics teaching?

2. RESEARCH METHODS

This research study used a multi-step development process to find out teachers' perceptions of language fostering in the context of Physics teaching. Specifically, the following steps were taken in this study:

(i) First, a literature review carried out to consider (1) the role of teachers in fostering students' language (scientific language), (2) teachers' perceptions and related factors of language enrichment.

(ii) Second, conclusions drawn from the literature review served as the basis for constructing a questionnaire to explore teachers' perceptions of language fostering in the context of physics teaching. The respondents were going to be physics teachers who had regularly worked with students with language difficulties in Vietnam. Experts were consulted to assess the validity and reliability of the questionnaire.

(iii) Finally, documentation research was also carried out to collect data from June 2020 to March 2021 of physics teachers who taught in high schools in Vietnam. The vertical-sectional survey of respondents was carried out with three components, ImportSL, SignSL, and FosterSL.

3. THEORETICAL FRAMEWORK AND PREVIOUS STUDIES

3.1. Physics Teachers' Perceptions of Language Fostering

3.1.1. Teachers' Beliefs about Integrating Content and Language in Physics Learning

Moje (2008) found that teachers held cultural beliefs about appropriate practices of their respective disciplines; however, many of these teachers who taught sciences, social studies, and mathematics had low initial beliefs about integrating content and literacy in their subjects. They rejected the idea that they were the best people to teach the conventions of literacy in their disciplines. Cammarata and Tedick (2012) argued about Canadian immersion teachers who "revisited and reshaped their teaching identity - to envision themselves not only as content teachers but language teachers as well" (p. 257). The study showed that content teachers did not usually focus on the quality of learners' disciplinary literacy and discourse in traditional classrooms. On the other hand, a few teachers proved that subject-specific literacies were irrelevant in language classrooms (Meyer, Coyle, Halbach, Schuck, & Ting, 2015). Challenging questions about academic language competence have also been raised in few studies. in a

research study of 140 Colombian teachers, data was revealed that all participants agreed that content and language integrated learning approach can benefit students, and help them develop both language skills and subject knowledge (meaningful communication) (McDougald, 2015). In Finland, Skinnari and Nikula (2017) scrutinized seven teachers of different subjects who were reasonably well aware of the subject-specific language of their field and the value of multi-literacy practices, but there was no impact of the diversity of students' languages on pedagogical practices.

3.1.2. Physics Teachers' Viewpoints of Language in Student's Learning Physics Process

The role of language in learning and teaching of science has been a shared form of knowledge, and scientific understanding inseparable from the written and spoken word (Evagorou and Osborne (2010)). Language functions play a central role in science as a key cognitive tool for developing higher-order thinking and problem-solving abilities which, in turn, supports academic literacy in all subject areas. However, learning a new language and the acquiring the vocabulary of science do pose problems and difficulties for learners (e.g. (Brookes, 2006; Henderson & Wellington, 1998; Sutton, 1996). The integrated content of language in learning classrooms is based on vocabularies and the subject-specific knowledge. There are words that relate to simply a name of a real object or entity: e.g., a clock, but concepts like acceleration does not refer to an object or an entity. These concepts are derived from velocity and experience (e.g. when a ball rolls down, its velocity is changed and acceleration is defined as the rate of change of velocity). Language learning in these contexts should best be approached as the attainment of academic and subject-specific vocabularies, genres, and ways of constructing knowledge (Nikula, 2012). In subject-specific semantic networks of, teachers usually construct and create linguistic bridges between everyday scientific vocabularies (e.g. (Escobar & Evnitskaya, 2014; Tolbert, 2011)). Gibbons (2002) rightly stated, "Explicit teaching is related to real-life use, so that language understanding is developed in the context of actual language use" (p. 109). In the context of teaching physics, Nikula (2015) explored that physics teachers introduced the theory and concepts related to the day's topic only during a post-task phase. Sometimes, in the practical process, the physics teacher requests students to clarify the meaning of concepts that resulted in collaboratively produced negotiations of subject-specific language. Mathematics is a tool in the learning process of physics, but the use and meaning of formal syntax differs dramatically between the two disciplines. During the learning process, students used math in doing physics, but they also used physics in doing math (Redish & Kuo, 2015). The differences in semantic meaning may be masked by the apparent similarity in the formal syntax, thus connecting and using mathematical 'words' and symbols in physics, which often cause students difficulties in learning physics (e.g. (Brookes, 2006; Wellington & Osborne, 2001)). Thinking about teaching mathematic for physics, Redish and Kuo (2015) suggested four steps (Figure 1) comprising processing, interpreting, evaluating and modeling. These steps help teachers focus on teaching physics more than just mathematical processing because their students can often tend to solve mathematical expressions without seeing their physical meaning.

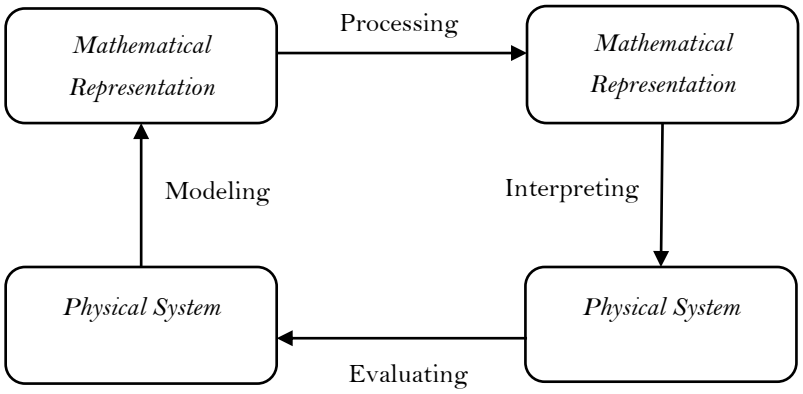

Figure-1. A model of mathematical modeling (Redish & Kuo, 2015)

3.1.3. Physics Teachers' Measures Use to Foster Language in the Teaching Process

To support students in successfully learning a language for scientific understanding, teachers need to choose such a language for their instructions that can optimally help them achieve their pedagogical objectives.(Nikula, 2012). A language system used in both disciplines of physics and language is demonstrated in a classroom environment through communication activities. In that environment, teachers and students communicate their ideas through different forms. Such demonstrations are not only confined to written texts, but also include non-verbal materials like visual/audio, graphic or symbolic representations, and actions (see (Meyer et al., 2015; Swain, 2000)).

(Swain, 2000) argued that unlike what happens when a learner is reading in a discussion, students have to speak in a way that makes it possible for others to understand their ideas. This would encourage them to process their language more deeply and sharply. Therefore, science talk is a tool that teachers can use in the teaching process to foster science language for students (e.g. (Exploratorium, 2015a, 2015b)). During a conversation, students can share their observations, interpret evidence, and explain their findings. They can support one another in making connections, refining ideas, and developing new perspectives. Students then can achieve an understanding of science individually. Such a student-to-student and student-to-teacher interactions also lead to the development of language. Gibbons (2002) observed: "Classroom conversations must create the conditions that will foster language development" (p. 24).

While preparing the integrating content and language lessons, teachers believe that learning is more efficient when they adapt their teaching materials to students' specific needs and also design new strategies of modifying materials. However, teachers do not always seem to be aware of some degree of adaptation of the authentic materials that they change. Bovellan (2014) observes that making use of adaptation strategies appear to be intuitive rather than based on prior investigation of results.

In physics teaching and planning a learner's experience, language acts as an interpretive system, used for generating new understanding. Language is also used as a labeling system for transmitting established information and convey meaning in different ways. Despite its limitations, the onus on a good teacher is to employ these different meaning appropriately, i.e. in the right place at the right time to enable learning science subjects more effectively (Wellington & Osborne, 2001). In another study, Jimenez-Silva and Gómez (2011) used four steps in the mode continuum of Gibbons (2002) to advance students from speaking to writing in science classes with experiments focusing on gravity e.g., the Chaotic Pendulum experiment was used specifically in this study. Generally, teachers need to provide a framework to address different needs of students by using a hands-on, project-based approach to science learning. This provides students with opportunities to listen, speak, read, and write; and to work cooperatively to develop both social and academic language skills.

3.2. Factors Related to Physics Teachers' Perceptions of Language Fostering

3.2.1. Teaching Experience

Shannag, Tairab, Dodeen, and Abdel-Fattah (2013) found that teaching experience affected significantly to practices of science teachers in Saudi Arabia and Singapore. Although, novice physics teachers are viewed commonly to be optimistic towards improving teaching approaches more than experienced physics teachers (Mohamad, Nasri, & Abd Talib, 2020). Nevertheless, even experienced teachers, with teaching experience of 5 years or more, tend to integrate content and language in their teaching. This suggests a multifaceted struggle involving issues related to teacher's identity, stakeholders' expectations, and relationship between language and content (Cammarata & Tedick, 2012). For Vietnamese teachers, Thao (2018) indicated that experienced teachers are different from new teachers, who have graduated "within the past ten years [and] may know more since they had been introduced to the concept when they were student teachers" (Thao, 2018). Further, Khuyen, Van Bien, Lin, Lin, and Chang (2020) categorized 186 Vietnamese teachers (most of them were science teachers) on the basis of

teaching experience and found statistical differences between groups. Hence, for this research, teaching experience was chosen as a variable to explore the differences in physics teachers' perceptions towards language in the context of their teaching

3.2.2. Education Background

The scientific training gained by teachers at the university builds their educational background (Martín-Díaz, 2006). Teachers who have an advanced degree in science or education with better teaching behaviors affect significantly and influence positively the students' science achievement (Zhang, 2008). The extensive knowledge, as well as the understanding of physics education ideas, are often found in physics teachers with master's or doctoral degrees (Mohamad et al., 2020). Khuyen et al. (2020) also found teachers with high-level education given a more reasonable recognition in Vietnam. Therefore, educational background was also considered as a variable of the current study.

4. REASEARCH CONTEXT

In Vietnam, the General Education Curriculum 2018 requires students' language literacy should be demonstrated through activities like listening, speaking, reading, and writing and must be implemented in all subjects, suitable to their characteristics and educational activities (Vietnam Ministry of Education and Training, 2018) (p.14). Currently, the integration of the content and language in learning is usually carried out by subject teachers rather than language teachers. Science books use a language that contains ample grammatical metaphors and technical and scientific terms (concepts) to develop texts. The use of language in science text books is "a kind of objective but user-unfriendly language which creates a feeling of alienation among school pupils" (Hoang, 2018).

In the context of physics teaching, though there are a few research studies on the language of physics in the Vietnamese context, none of them have examined the role of language in fostering skills. These studies have emphasized to provide training to students in the language of physics as part of measures to help foster and develop their competencies such as problem-solving or doing experiments. (Thang, 2003). In 2018, a study recommended the application of the LAMAP teaching process (Tra, 2013) to enhance students' problem-solving competences via cognitive activities of thermo-logical knowledge - Grade 8. One of the conclusions stated: "90% of the teachers commented that through the activities, students have acquired knowledge and developed written and spoken language;" however, the study did not analyze the opportunities and results of language fostering for students(Thuy, 2018). The current study is an attempt to fill this research gap.

5. INVESTIGATIVE REASEARCH

5.1. General Background

Based on the literature review and in the Vietnam context, a research model was chosen for the current study with five variables: (i) Teachers' beliefs; (ii) Physics teachers' viewpoints; (iii) Physics teachers' measures; (iv) Teaching experience; and (v) Educational background. To ensure the validity of the model, it was reviewed by a panel of experts. We selected ten experts who were active lecturers in universities of education. The experts disagreed with a few points, in terms of content and expression, and offered advice on some modifications. Based on the feedback from the experts, a few modifications were made e.g., out of 5 variables, only the first 3 variables were made dependent variables: teachers' beliefs (ImportSL), physics teachers' viewpoints (SignSL), and physics teachers' measures (FosterSL). Teaching experience and educational background were independent variables.

The data obtained facilitated analyzing the potential influence of educational background and teaching experience on teachers' perception of language fostering for students. The model was designed to explain teachers' perceptions of language fostering in the context of Physics teaching in mountainous areas of Vietnam. In this study, physics teachers were categorized based on their teaching experiences or education backgrounds to examine

whether there was any difference in the subsamples' perceptions of language fostering of physics. Figure 2 depicts teachers' perceptions of the language fostering in the context of physics and factors utilized to categorize the participants.

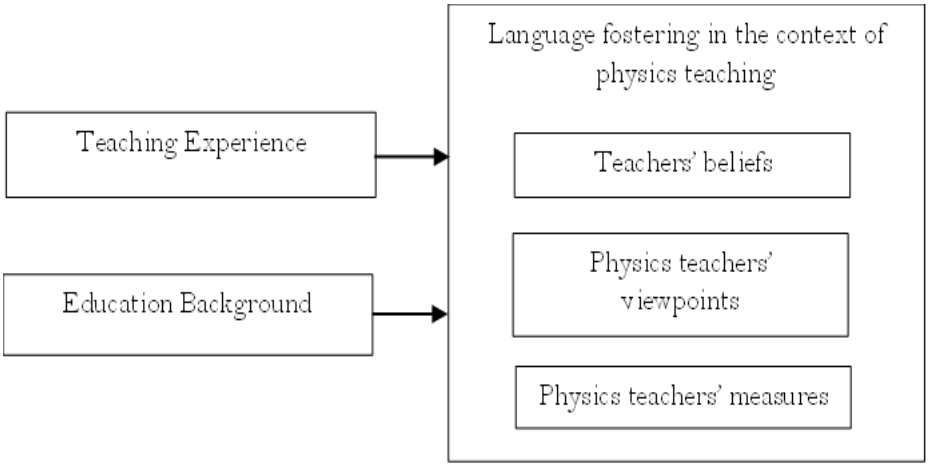

Figure-2. The variable data for categorizing subsamples.

5.2. Sample Selection

The sample was chosen randomly and Facebook was the platform to collect the survey data. There were 98 teachers who submitted feedback and participated voluntarily in this research. After removing teachers who were teaching different subjects other than physics, and duplicate responses, 64 physics teachers of different educational backgrounds and levels were identified as the sample of this study. All participants belonged to the nine mountainous provinces in Vietnam. The number of teachers from Son La province accounted for the most, with nearly 67.2% (Son La is one of the three poorest provinces of Vietnam). Most participants had a bachelor's degree (87.5%) and over half of the participants had 10 to 20 years' physics teaching experience. The research question was answered by participants via combining descriptive and quantitative analysis.

Table 1 illustrates the distribution of teachers by educational background and teaching experience.

Table-1. The distribution of teachers by education background and teaching experience

Variable	N	Percentage (%)
Education background		
• Bachelor	56	87.5
• Master and Ph.D.	8	12.5
Physics teaching experience		
• < 5 years	8	12.5
• 5–10 years	20	31.3
• 10–20 years	34	53.1
• > 20 years	2	3.1

5.3. Questionnaires and Procedures

The current study aimed to interpret how teachers perceived language fostering in the context of physics teaching by measuring (1) Physics teachers' beliefs (ImportSL), (2) Physics teachers' viewpoints (SignSL), and (3) Physics teachers' measures (FosterSL). This study argued that physics teachers who have been intensively trained in physics pedagogy in Vietnam and who have the experience of direct classroom teaching, can be considered experts in the language of physics. There were three steps of this research study:

First, teachers' beliefs were determined on the basis of their responses to the importance of integrating content and language teaching in physics (ImportSL) on a scale of 0 (extremely unimportant) to 10 (extremely important).

Secondly, teachers were asked to respond to a four-point scale from completely disagree to completely agree to evaluate the viewpoints of language in the student's learning process (SignSL), which included following 3 items. The factor loadings through these items ranged from 0.654 to 0.914.

(1) Physical terminologies.

(2) Representations used in physics.

(3) The process of arguing, proving, or explaining physical knowledge.

Finally, participants responded to a five-point Likert scale of 5 levels using measures (from Never to Always) to give their opinion on fostering language in physics teaching process (FosterSL), which included following 4 items. The factor loadings were recorded between 0.549 and 0.819.

(1) Creating situations of communication activities in the learning process.

(2) Using intuitive experiences, practical physical situations associated with the daily life of mountain students.

(3) Appropriate use of instruction and practice forms.

(4) Using a combination of different support forms.

The sampling adequacy was calculated by The Kaiser–Mayer–Olkin (KMO) and Barlett's test of sphericity. The KMO sampling adequacy test score was $0.557 > 0.5$, which would indicate that these variables were related (Cohen & Manion, 2011). Barlett's test of sphericity was at the $p < 0.001$ level. The total variance of the two factors was identified in 60,62%. The principal component and Varimax with the Kaiser normalization were validated with SignSL (3 items) and FosterSL (4 items). All observed variables had factor loading coefficients in the range from 0.601 to 0.899, which was also consistent with the sample size collected from 64 teachers (Hair, Black, Babin, & Anderson, 2019).

The two components are SignSL (item 2 to 4), and FosterSL (item 5 to 8). The Cronbach alphas of SignSL and FosterSL were calculated respectively 0.704 and 0.695, which were considered reliable (Cohen & Manion, 2011). In this study, the calculated alphas indicated reliability, as internal consistency. Finally, the research had the 8-item instrument, including three components, namely ImportSL (1 item), SignSL (3 items), FosterSL (4 items).

5.4. Data Analysis

The score ratio for the importance (ImportSL) was calculated and described as physics teachers' perceptions of integrating content and language teaching in physics. In addition, T-test and one-way ANOVA were utilized to explore by comparing the differences between subsamples. Specifically, the differences in teachers' perceptions in different groups categorized as teaching experience and education background were interpreted. Coefficients of the Pearson Correlation between three components were also considered to explain why the survey was explored vertically. All analyses were completed using SPSS 20.

5.5. Investigative Research Results

5.5.1. Physics Teachers' Perceptions of Language Fostering in the Context of Teaching

Responses about the importance of integrating content and language teaching in physics were collected on a scale from 0 to 10. The results obtained are shown in the graph in Figure 3. The graph shows all participants with a rate more than 5 points, with point 8 representing the highest number with 21 teachers, accounting for 32.8% of the sample.

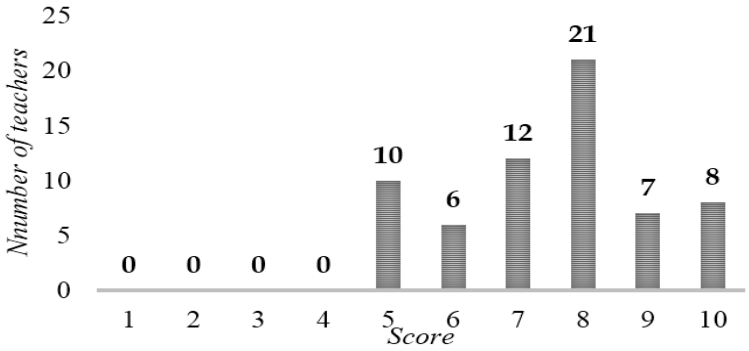

Figure-3. The importance of integrating content and language teaching in physics.

The mean of each domain was calculated to interpret the overall physics teachers' perceptions of viewpoints of language (SignSL: M = 1.91, SD = 0.06) and measures use to foster language in the teaching process (FosterSL: M = 2.42, SD = 0.55). The following boxplots illustrates the distribution of each domain (Figure 4). For SignSL, the third quartile (Q3) is seen almost equal to the median of the first domain. In other words, more than 75% of teachers 'agreed' and 'quite agreed' with the items about the viewpoints of language in teaching physics. The median of the second domain (FosterSL) was 2.42. The data reveals that 50% of participants responded they used measures 'sometimes' or 'usually' to foster language in the teaching process.

To summarize, there were optimistic viewpoints of language in learning of physics teachers, and they used measures that helped them to foster language in Vietnam.

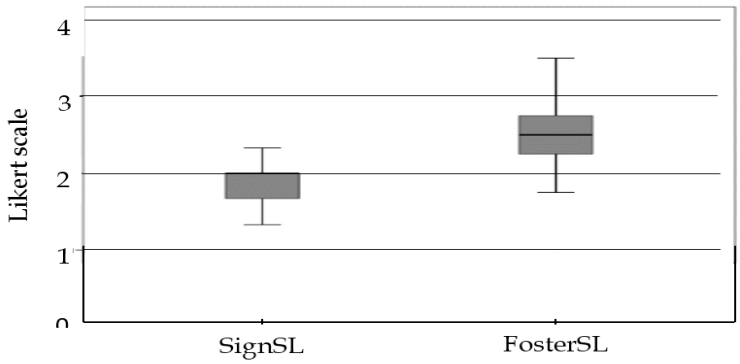

Figure-4. Distribution of each domain in the survey instrument.

Table-2. Means, standard deviations, and the 95% confident interval (CI) of the SignSL and FosterSL.

Variable	M	SD	95% CI	
			LL	UL
SignSL				
(1) Physical terminologies	2.14	0.560	2.00	2.27
(2) Representations used in physics	1.83	0.579	1.69	1.97
(3) The process of arguing, proving or explaining physical knowledge	1.77	0.684	1.61	1.94
FosterSL				
(1) Creating situations of communication activities in the learning process	2.42	0.558	2.30	2.55
(2) Using intuitive experiences, practical physical situations associated with the daily life of mountain students	2.30	0.582	2.16	2.44
(3) Appropriate use of instruction and practice forms	2.28	0.576	2.13	2.42
(4) Using a combination of different support forms	2.67	0.691	2.50	2.83

Note: CI refers to confident interval, LL refers to lower limit, UL refers to upper limit.

There were three viewpoints of language and four measures that teachers used to foster language. Respondents were asked to assess the consent level, and usage level in physics teaching. Table 2 shows the mean, the standard deviation, and the 95% confidence intervals (CI) of each item in SignSL and FosterSL. On viewpoints of language in the student's learning process, the physical terminologies were advocated as the most consensus, while the process

of arguing, proving, or explaining physical knowledge was agreed least. For measures used, the combination of different support forms and creating situations of communication activities in the learning process were used most, and the appropriate use of instruction and practice forms was used the least in the teaching process.

5.5.2. Differences in Teachers' Perceptions of Language Fostering in the Context of Physics Teaching Based on Teaching Experiences and Education Background

In order to explore whether there was any difference in the subsamples' perceptions of language fostering in the context of physics teaching, Independent Samples T-Test and one-way ANOVA were utilized . The mean (M) and standard deviation (SD) of each group are illustrated in Table 3. Overall, teachers with experience of more than 20 years had the lowest beliefs in integrating content and language learning in physics (ImportSL, M = 7.00), but they were most supportive with measures to foster language in physics (FosterSL, M = 2.50). Teachers having a Master's and Ph.D. degrees had the mean scores higher than teachers having bachelor's. In other words, teachers who had a higher level of education had a greater perception of language fostering in the context of physics teaching.

The results of the t-test show different variances of teachers who had Masters and Ph.D. degrees in ImportSL and FosterSL. The one-way between-groups ANOVA was conducted to explore differences in teachers' perception between groups categorized by teaching experience. There were differences at the Levene's test with sig. < 0.05 level in all 3 components (Levene's test sig was 0.013; 0.005; 0.006). This suggests that the current research had enough variance in the sample to account for possible mean differences. The resulting score of eta-squared showed, for SignSL in teaching physics between groups, is seen medium while the actual differences in mean scores (η^2 = 0.098). The actual differences in mean scores between groups were small in ImportSL (η^2 = 0.024) and FosterSL (η^2 = 0.018).

Most of the physics teachers in this research have agreed on the role of language integration in their subjects. But, compared to the veteran teachers, the novice teachers (< 5 years) perceived basically the importance of language as more valuable. The Post hoc - the Tukey HSD test was used, and the comparisons indicated that the biggest difference was between the two groups of teachers with the least experience (< 5 years) and the group of teachers with the highest experience (> 20 years). The post hoc comparisons are shown in Table 4.

Besides, in order to analyze the correlation between components in teacher's perception research model, the Pearson correlation coefficients between three components were calculated and are illustrated in Table 5. Coefficients of the Pearson Correlation between ImportSL with SignSL and FosterSL shows sig. < 0.01. In other words, teachers showed higher beliefs about integrating content and language learning in the context of physics teaching. They also agreed higher levels and greater use of measures to foster language in their teaching process.

Table-3. Teachers' perception based on teaching experience, and education background.

Variable		ImportSL				SignSL				FosterSL			
Teaching Experience	**n**	**M**	**SD**	**Levene**	η^2	**M**	**SD**	**Levene**	η^2	**M**	**SD**	**Levene**	η^2
< 5 years	8	8.00	2.330	0.013	0.024	2.08	0.793	0.005	0.098	2.41	0.778	0.006	0.018
5 – 10 years	20	7.65	1.725			2.07	0.525			2.34	0.475		
10 – 20 years	34	7.35	1.228			1.80	0.329			2.46	0.315		
> 20 years	2	7.00	1.414			1.50	0.240			2.50	0.000		
Education background	n	M	SD	Levene	t	M	SD	Levene	t	M	SD	Levene	t
Bachelor	56	7.50	1.452	0.032	0.880	1.89	0.464	0.361	0.284	2.42	0.390	0.011	0.855
Master and PhD	8	7.63	2.200			2.08	0.611			2.38	0.720		

Table-4. Post hoc comparison in teachers' perception of integrating content and language teaching in physics

Demographic Category		ImportSL		SignSL		FosterSL	
(I)	(J)	Mean Difference (I-J)	SE	Mean Difference (I-J)	SE	Mean Difference (I-J)	SE
Teaching Experience							
< 5 years	5 – 10 years	0.350	0.653	0.017	0.197	0.069	0.185
< 5 years	10 – 20 years	0.647	0.614	0.278	0.185	- 0.057	0.174
< 5 years	> 20 years	1.000	1.235	0.583	0.372	- 0.094	0.350
5 – 10 years	10 – 20 years	0.297	0.440	0.262	0.133	- 0.126	0.185
5 – 10 years	> 20 years	0.650	1.158	0.566	0.349	- 0.163	0.125
10 – 20 years	> 20 years	0.353	1.136	0.304	0.342	- 0.037	0.323

Note: SE refers to Standard Error.

Table-5. The Pearson Correlation coefficients between three components.

		Import SL	Sign SL	Foster SL
ImportSL	Pearson Correlation (p)		0.552**	0.352**
	Sig.		0.000	0.004
SignSL	Pearson Correlation (p)	0.552**		0.134
	Sig.	0.000		0.291
FosterSL	Pearson Correlation (p)	0.352**	0.134	
	Sig.	0.004	0.291	

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

6. DISCUSSION

The physics teachers in Vietnam perceive the importance of language in their subject and also require integrating the content and language in the teaching process. Most of physics teachers who participated in this study agreed that the language in physics is not limited to just physical terminologies, but it also includes processes of physical representations and reasoning process to prove/explain physical knowledge. Vocabularies are the important component of teaching, but the objective to teaching a subject cannot be limited to teaching word meanings (Regalla, 2012). The important thing is to encourage students to think and act like scientists or rather deeply understand the subject's practices. (Tolbert, 2011). This is more meaningful in the context of radical and comprehensive reform of Vietnam general education, which insists upon moving from knowledge acquisition to the quality and competency development of students (Vietnam Ministry of Education and Training, 2018).

Learning content knowledge and language are situated in relevant contexts of the renewed teaching process. Further, teachers need to broaden their perception of the notion of subject-specific language, to complete the learning process in a much more multimodal fashion (Kääntä, 2021). In terms of pedagogic measures, using a combination of different support forms and creating situations of communication activities in the learning process are used more than other measures. The findings showed that a physics teacher in Vietnam has used learner-centered approaches or "Learners are at the center of the educational process". This is consistent with the trend of "Fundamental and comprehensive innovation in education" in Vietnam. In addition, to give appropriate instruction, teachers should attend to the characteristics of ethnic minority students' communication skills and provide them appropriate instructions. There are many students in Vietnam who belong to ethnic minorities. e.g. Muong. These ethnic students use their sensory skills to communicate among which listening to objects is their weakest ability (Ha, 2012). In fact, the cultural diversity in ethnic minority students affected their choice of a suitable type of learning (Trang et al., 2020).

In our finding, novice teachers were seen more optimistic about the role of language in physics. The integrating content and language learning in physics were evaluated and it was found that physics teachers used more often in their teaching process. Similarly, teachers who had higher educational background performed better and pedagogic innovations were found more in teachers who held a postgraduate degree. The General Education Curriculum (2018) postulates, "science education has become one of the most innovative fields. Science teachers

study and become familiar with teaching science in an integrated way that demands that science teachers be equipped with new knowledge and teaching methods" (Hien, Bich, Huong, Hue, & Nguyet, 2020).

7. CONCLUSION AND IMPLICATIONS

This research interpreted physics teachers' perceptions of language fostering in the context of physics teaching in Vietnam. Most Vietnamese participants held positive views on integrating content and language in teaching their subject. This reflects part of the teachers' consensus to meet the needs of educational reforms in Vietnam. In this process, additional fostering for physics teachers in both academic and training qualifications is essential.

There are some key findings in this research, firstly novice physics teachers held more positive views of language fostering in the context of physics teaching since they had the access to more knowledge and skills resources when they were student teachers. Secondly, there were differences in teachers' perceptions between subsamples categorized by especially teaching experience. These results could prove a valuable information for designing teaching processes of language fostering in physics teaching for students in Vietnam. Further studies need to be carried out on topics like how physics teachers evaluate the language of students in the context of physics learning.

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REFERENCES

Bovellan, E. (2014). *Teachers' beliefs about learning and language as reflected in their views of teaching materials for content and language integrated learning (CLIL)*. Doctoral Dissertation, Jyväskylä Studies in Humanities 231,

Brookes, D. T. (2006). *The role of language in learning physics*. Doctoral Dissertation, Rutgers University, USA, Retrieved from https://per.physics.illinois.edu/people/David/thesis_Y2.pdf

Cammarata, L., & Tedick, D. (2012). Balancing content and language in instruction: The experience of immersion teachers. *The Modern Language Journal, 96*(2), 251–269. doi:https://doi.org/10.1111/j.1540-4781.2012.01330.x

Cohen, K., & Manion, L. (2011). *Research methods in education*. London, UK: Routledge.

Escobar, U. C., & Evnitskaya, N. (2014). Do you know actimel?' The adaptive nature of dialogic teacher-led discussions in the CLIL science classroom: A case study. *The Language Learning Journal, 42*(2), 165-180. doi:https://doi.org/10.1080/09571736.2014.889507

Evagorou, M., & Osborne, J. (2010). *The role of language in the learning and teaching of science*. New York: Open University Press/McGraw-Hill.

Exploratorium. (2015a). Developing language in the context of science: A view from the institute for inquiry. The Institute for Inquiry. Retrieved from https://www.exploratorium.edu/education/ifi/inquiry-and-eld/educators-guide/conceptual-overview. [Accessed 05/04/2018].

Exploratorium. (2015b). Science talk: A tool for learning science and developing language. The Institute for Inquiry. Retrieved from https://www.exploratorium.edu/education/ifi/inquiry-and-eld/educators-guide/science-talk. [Accessed 05/04/2018].

Gibbons, P. (2002). *Scaffolding language, scaffolding learning: Teaching second language learners in the mainstream classroom*. Portsmouth, NH: Heinemann.

Gioi, V. N. (2011). *Developing communication skills for students of Ha Giang ethnic boarding high school*. Master Thesis, Thai Nguyen University of Education. Viet Nam.

Ha, P. S. (2012). *Communication characteristics of Muong ethnic middle school students*. Doctoral Dissertation, Graduate Academy of Social Sciences,

Hair, J. F., Black, W. C., Babin, B. Y. J., & Anderson, R. E. (2019). *Multivariate data analysis*. New Jersey: Pearson.

Henderson, J., & Wellington, J. (1998). Lowering the language barrier in learning and teaching science. *School Science Review*, *79*(288), 35-46.

Hien, V. N., Bich, H. V. N., Huong, M. T. V., Hue, K. T. H., & Nguyet, M. T. N. (2020). Vietnamese education system and teacher training: Focusing on science education. *Asia-Pacific Science Education*, *6*(1), 179–206. doi:https://doi.org/10.1163/23641177-BJA10001

Hoang, V. V. (2018). The language of Vietnamese school science textbooks: A transitivity analysis of seven lessons (Texts) of biology 8. *Linguistics and the Human Sciences*, *14*(1-2), 1-35. doi:https://doi.org/10.1558/lhs.31751

Jimenez-Silva, M., & Gómez, C. L. (2011). Developing language skills in science classrooms. *Science Activities*, *48*(1), 23-28. doi:https://doi.org/10.1080/00368121.2010.495141

Kääntä, L. (2021). Multimodal perspective into teachers' definitional practices: Comparing subject-specific language in physics and history lessons. In I. S. K. A. N. M. A. O. S. (Eds.), Classroom-based Conversation Analytic Research: Theoretical and Applied Perspectives on Pedagogy. In (pp. 197–223). United States: Springer.

Khuyen, N. T. T., Van Bien, N., Lin, P.-L., Lin, J., & Chang, C.-Y. (2020). Measuring teachers' perceptions to sustain STEM education development. *Sustainability*, *12*(4), 1-15. doi:https://doi.org/10.3390/su12041531

Martín-Díaz, M. J. (2006). Educational background, teaching experience and teachers' views on the inclusion of nature of science in the science curriculum. *International Journal of Science Education*, *28*(10), 1161-1180. doi:https://doi.org/10.1080/09500690500439504

McDougald, J. (2015). Teachers' attitudes, perceptions and experiences in CLIL: A look at content and language. *Colombian Applied Linguistics Journal*, *17*(1), 25-41. doi:10.14483/udistrital.jour.calj.2015.1.a02

Meyer, O., Coyle, D., Halbach, A., Schuck, K., & Ting, T. (2015). A pluriliteracies approach to content and language integrated learning–mapping learner progressions in knowledge construction and meaning-making. *Language, Culture and Curriculum*, *28*(1), 41-57. doi:https://doi.org/10.1080/07908318.2014.1000924

Mohamad, N. N., Nasri, N., & Abd Talib, M. A. (2020). Physics teachers' perceptions on sustainable physics education. *Journal of Baltic Science Education*, *19*(4), 569-582. doi:https://doi.org/10.33225/jbse/20.19.569

Moje, E. B. (2008). Foregrounding the disciplines in secondary literacy teaching and learning: A call for change. *Journal of Adolescent & Adult Literacy*, *52*(2), 96-107. doi:https://doi.org/10.1598/jaal.52.2.1

Nikula, T. (2012). On the role of peer discussions in the learning of subject-specific language use in CLIL. In I. E. A. S. M.-P. S.-J (Ed.), Discourse and language learning across L2 instructional settings. Utrecht Studies in Language and Communication (24). In (pp. 133–153). Amsterdam: Rodopi.

Nikula, T. (2015). Hands-on tasks in CLIL science classrooms as sites for subject-specific language use and learning. *System*, *54*, 14-27. doi:10.1016/j.system.2015.04.003

OECD. (2016). PISA 2015 reading framework. In, *in PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematic, Financial Literacy and Collaborative Problem Solving* (pp. 47-61). OECD Publishing, Paris, France.

Redish, E. F., & Kuo, E. (2015). Language of physics, language of math: Disciplinary culture and dynamic epistemology. *Science & Education*, *24*(5-6), 561-590. doi:https://doi.org/10.1007/s11191-015-9749-7

Regalla, M. (2012). Language objectives: More than just vocabulary. *TESOL Journal*, *3*(2), 210-230. doi:https://doi.org/10.1002/tesj.15

Shannag, Q. A., Tairab, H., Dodeen, H., & Abdel-Fattah, F. (2013). Linking teacher quality and students' achievements in the Kingdom of Saudi Arabia and Singapore: The impact of teachers' background variables on student achievement. *Journal of Baltic Science Education*, *12*(5), 652-665.

Skinnari, K., & Nikula, T. (2017). Teachers' perceptions on the changing role of language in the curriculum. *European Journal of Applied Linguistics*, *5*(2), 223-244. doi:https://doi.org/10.1515/eujal-2017-0005

Sutton, C. (1996). Beliefs about science and beliefs about language. *International Journal of Science Education*, *18*(1), 1-18. doi:https://doi.org/10.1080/0950069960180101

Swain, M. (2000). The output hypothesis and beyond: Mediating acquisition through collaborative dialogue. In U. J. Lantolf. Oxford (Ed.), Sociocultural Theory and Second Language Learning. In (pp. 97-114). England: Oxford University Press.

Thang, N. T. P. (2003). *Improving the teaching quality of the "electromagnetic induction and alternating current" module in ethnic boarding middle schools through fostering problem-solving capabilities for students.* Doctoral Dissertation, Ha Noi National University of Education.

Thao, N. P. (2018). Education for sustainable development in Vietnam: exploring the geography teachers' perspectives. *International Research in Geographical and Environmental Education*, *27*(4), 341-356. doi:https://doi.org/10.1080/10382046.2017.1366204

Thuy, N. T. (2018). *Promoting problem-solving capability for students via the cognitive activities of thermological knowledge in the junior high school curriculum under the view of LAMAP.* Doctoral Dissertation. Ha Noi National University of Education.

Tolbert, S. (2011). Science education as a pathway to teaching language literacy: A critical book review. *Cultural Studies of Science Education*, *6*(1), 251-263. doi:https://doi.org/10.1007/s11422-010-9302-6

Tra, D. H. (2013). *LAMAP - a modern teaching method*: University of Education Publishing House. Viet Nam.

Trang, N. T., Tran, T., Nguyen, L. M. T., Pham, T. V., Nguyen, T. P. T., Pham, H. T., & Pham, B. D. (2020). Influence of ethnic culture in choosing the learning type of ethnic minorities: Evidence from Northwest of Vietnam. *Cogent Social Sciences*, *6*(1), 1753487. doi:https://doi.org/10.1080/23311886.2020.1753487

Vietnam Ministry of Education and Training. (2018). Circular No. 32/2018/TT-BGDDT (2018, December 26) (Promulgation of the new general education curriculum).

Wellington, J., & Osborne, J. (2001). *Language and literacy in science education.* Buckingham: Open University Press.

Zhang, D. (2008). *The effect of teacher education level, teaching experience.* And Teaching Behaviors on Student Science Achievement All Graduate Theses and Dissertations. 155. Utah State University.