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Development and Validation of a Questionnaire to Understand Students' Perceptions of Bilingual Education in Taiwan

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Abstract: This study employed a localized bilingual education model developed in Taiwan to design a questionnaire targeted at junior high school students. The questionnaire was validated using exploratory factor analysis. Reliability testing indicated Cronbach's alpha values for subscales ranging from 0.88 to 0.95, with an overall Cronbach's alpha of 0.98. A total of 760 junior high school students in Taipei City who have received bilingual instruction completed the questionnaire. The results demonstrate that the questionnaire has high construct validity and internal consistency, making it a practical tool to evaluate students' perceptions of bilingual education. Future studies should focus on qualitative research such as in-depth interviews, extend the survey to students at the university and primary school levels, and verify the questionnaire's structure through confirmatory factor analysis.

Keywords: bilingual education; exploratory factor analysis; FERTILE model; perceptions

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1. Introduction

In 2018, the Taiwan government announced the "Blueprint for Developing Taiwan into a Bilingual Nation by 2030", an ambitious policy initiative aimed at enhancing Taiwan's global competitiveness and economic resilience. Recognizing the pivotal role of English as a global lingua franca, the government has sought to integrate bilingual education—focusing on Mandarin and English—into its educational framework. The policy aims to enhance Taiwan's competitiveness and economic advantages through bilingual education [1]. In response to the demand for improving the English proficiency of Taiwanese high school students, the Taiwan Ministry of Education has promoted the integration of English into the teaching of various subjects, including art and music, among many others [2]. This cross-disciplinary approach is intended to create an immersive learning environment in which students are exposed to English in practical, content-rich contexts, thereby accelerating their language development while enriching their overall education.

Researchers have embraced theories of beneficial multilingualism and literacy learning (e.g., [3–6]), noting that multilingual students often develop stronger vital critical thinking skills and greater cognitive flexibility, which contribute to improved academic outcomes and cultural awareness. Taiwan's approach to bilingual education aligns with these findings, offering students opportunities to build these advantages through an integrated learning process. This paper's definition of bilingual education is based on Garcia & Baetens [7] and Wright et al. [8], who state that bilingual education involves the use of two languages in the teaching and learning process. Considering Mandarin as the common language and English as the target language, the Taiwan Bilingual 2030 Policy aims to progressively increase the use of English in academic settings, ultimately leading

to widespread bilingual fluency among Taiwanese students [2]. The overarching goal of bilingual education in Taiwan is twofold: (1) to first gradually adjust the use of language in curriculum and instruction to help students become fluent in English and then improve communication skills by establishing a holistic bilingual environment in schools [2] and (2) to cultivate students' respect and tolerance for multicultural global literacy [7].

Various studies have investigated the practices of bilingual teaching in different contexts. Kirkpatrick & Bui [8] indicated that immersion teaching is an effective learning method, whether for immigrant mother tongue or foreign language learning, and argued that such approaches can eventually lead to mastery of the target language. Moreover, Marian et al. [9] addressed significant claims that bilingual two-way immersion models are beneficial in multiple ways and should be seriously considered when designing and implementing educational programs. In addition to the potential improvements in academic performance, students also stand to gain proficiency in both languages. This ability to communicate in two languages and interact with a more significant proportion of the population is an asset for them as they enter an increasingly globalized world. Meanwhile, Irby et al. [10] and Slavin et al. [11] demonstrated that bilingual education programs lead to successful academic performance in English while further developing students' proficiency in their native language. Additionally, content and language-integrated learning (CLIL) has been widely implemented in European countries such as the Netherlands, Finland, and Spain [12–14].

Lin [15] proposed the "FERTILE" Model for promoting bilingual education in Taiwan. This model is grounded in the comprehensive input [16] and interaction hypothesis [17,18], which encompasses three critical elements: international intelligibility, student comprehensibility, and content engagement [15,19]. The model also emphasizes the following principles: (1) the promotion of bilingual education requires flexibility, (2) the promotion of bilingualism must be based on the establishment of the environment, (3) the effect of role modeling in the school, (4) sufficient time must be provided to promote bilingual education, (5) principles of instructional strategies for class teaching, (6) students should be cared for by analyzing their learning needs and applying differentiated instruction during bilingual teaching, and (7) engage with stakeholders.

Lin [20] has affirmed that the impact of bilingual education on junior high schools in Taiwan depends on two factors: (1) whether the school transforms itself into a bilingual environment and (2) whether students understand that both languages are communication tools in school. Bilingual education in Taiwan should not be equated to all-English teaching, as teachers utilize both Mandarin and English to deliver subject content rather than using only English; should students lack sufficient language skills or knowledge, their learning effectiveness will be negatively affected. Wang & Lin [2] pointed out that by creating a high-quality English learning environment, students will consider English as a language of communication rather than a school subject with required tests, thereby encouraging them to use English in their daily lives and to interact with people.

The aforementioned literature review highlights key aspects of cognition related to the development and promotion of bilingual education. It can be summarized as follows: bilingual education involves using two languages as the medium of instruction in the classroom [21,22]. Caution must be exercised to avoid directly transplanting exotic experiences or teaching approaches, such as immersion or content and language integrated learning (CLIL), without considering their original contexts. The target language should be part of the daily communicative environment [19,23]. Therefore, establishing a whole-school bilingual environment becomes the crucial base of the FERTILE model [2,22]. Ultimately, the goal is for principals, heads of departments (HoDs), teachers, and students in the school to become bilingual [23]. In other words, all the stakeholders within the school setting should be good bilingual role models to their students.

While considerable attention has been paid to bilingual education-related research issues overseas, the related literature's development in Taiwan has emerged gradually and in a fragmented manner. Taiwan is in the early stages of promoting bilingual education,

requiring a clearer understanding of the situation at all levels of schooling and avoiding inconsistent interpretations of policies. Further participation and effort are needed to promote bilingual education effectively. To date, no clear direction has emerged regarding how bilingual teaching should be implemented in pre-university education in Taiwan.

The questionnaire used in this study is based on the FERTILE model. This questionnaire focuses on exploring students' perceptions of content-focused bilingual teaching. This model, developed by Lin [15], was selected because it is a locally developed bilingual model based on various case studies of schools practicing bilingual education in Taiwan [20]. Furthermore, the model is based on the comprehensive input of three important elements: (1) international comprehensibility, (2) student comprehensibility, and (3) content engagement, whether interactively relevant. The purpose of the research presented in this article was to develop the "Student Perspectives on the Acceptance of Promoting Bilingual Education Questionnaire" for junior high schools in Taiwan from the perspective of Taiwan's localized bilingual education. The article explains the process of item generation, how validation of the questionnaire was performed by exploratory factor analysis (EFA), and how internal consistency was assessed.

Lin [24] points out that, due to the ill-defined goal of bilingual education, bilingual teachers are confused with the potential outcome of their bilingual teaching. The assumption of the FERTILE model is that bilingual teachers should focus on teaching the subject content knowledge and not emphasize the learning of the target language. English as the target language should be taught by professional language teachers. Other bilingual teachers who are not trained as experts in teaching the English language should only teach their respective subjects such as health education, music, arts, and physical education. With this in mind, this study investigates the following research question from students' perspectives: do subject teachers in Taiwan possess relevant knowledge of content-oriented bilingual teaching, and can they provide sufficient language input to students so that a proper bilingual environment can be established within the classroom, as the FERTILE model addresses?

In conclusion, the discussion presented in this article can assist schools and policymakers interested in promoting bilingual education by providing practical strategies for reference. This study may be critically significant in laying the groundwork for understanding how language learners utilize learning strategies. Lin [23] agrees that the primary English proficiency of junior high schools in Taiwan still requires further improvement; however, bilingual education is worth receiving affirmation and support.

2. Materials and Methods

2.1. Context and Participants

To examine the effectiveness of the FERTILE model in the bilingual teaching field, nine bilingual teachers covering different subjects were selected from six schools in Taipei City. The nine bilingual teachers underwent a professional development program that adopted the FERTILE model as its core, thus ensuring they understood the model thoroughly and could implement it in their teaching practice. The students of these teachers were chosen as the research participants. A total of 760 junior high school students participated in this study, consisting of 365 (48%) females and 395 (52%) males across grades 7 and 8 (ages 12 to 13 years, M = 1.52, SD = 0.50). All participants attended schools in Taipei City.

2.2. Research Instrument

To measure students' acceptance of promoting bilingual education in schools, the researchers designed the first questionnaire grounded in the FERTILE model for junior high schools in Taiwan, titled "Student Perspectives on the Acceptance of Promoting Bilingual Education Questionnaire". The questionnaire includes eight aspects: (1) the application of bilingual teaching for teachers, (2) the application of multimodal teaching by teachers, (3) bilingual teaching strategies provided by teachers for students with difficulty learning, (4) students' understanding and application of bilingual curriculum content,

(5) strategies for students to deal with learning difficulties, (6) students' acceptance of the implementation of the bilingual curriculum policy, (7) contributions to students' language abilities, and (8) the establishment of a bilingual environment in schools. The questionnaire was pre-constructed and subsequently validated by bilingual learners.

2.3. Procedures

The procedures followed in this study comprised designing and validating the questionnaire. To design the questionnaire, the researchers derived the indicators of bilingual teaching from a previous study [15]. Opinions were obtained from three language teaching specialists and three junior high school English teachers invited to a meeting, from which several bilingual teaching indicators most relevant and applicable to the context of Taiwanese students were selected. This process resulted in a checklist of bilingual teaching indicators, which served as the basis for constructing the questionnaire items. First, joint consultations were held to refine a checklist from a previous study, followed by revisions of the items. Next, the newly developed questionnaire was presented to junior high school English teachers and students for content evaluation, to assess whether the items were understandable. Finally, the researchers removed items with ambiguous wording according to feedback from teachers and students. To achieve this, three English teachers and their students whose characteristics were similar to those of the target population were invited to revise the questionnaire to eliminate any ambiguity that could lead to misunderstandings on the part of the participants.

The questionnaire comprises 30 items, measured using the eighth subscale, "Student Perspectives on the Acceptance of Promoting Bilingual Education Questionnaire." The items are scored according to a five-point Likert-type scale, ranging from (1) "strongly disagree" to (5) "strongly agree".

2.4. Data Analysis

The internal consistency of the entire questionnaire was assessed, and the reliability of each factor within the validated questionnaire was also estimated using Cronbach's alpha. Additionally, the study validated the questionnaire using exploratory factor analysis (EFA). Principal component analysis (PCA) was employed to extract the underlying factors by calculating the eigenvalues of the matrix greater than 1.0, and the scree test was used to determine the number of factors to retain for rotation. Consequently, Varimax (orthogonal rotation) with the Kaiser criterion was used for factor rotation. As a result, the rotated component matrix indicated the variables loaded on each factor.

3. Results and Discussion

The research participants were 760 junior high school students in Taipei City who were sampled online. A total of 100% of valid questionnaires were obtained. After considering the empirical data of item analysis, along with the results of logical analysis and referring to the feedback from other scholars [25–28], the researchers proceeded to use item analysis to evaluate the appropriateness of each questionnaire item, with the aim of removing unsuitable items and improving the quality of the questionnaire.

3.1. Descriptive Statistics

Descriptive statistics typically include four statistics—mean, standard deviation, skewness, and kurtosis—to evaluate each item's score. If the percentage of missing values for an item exceeded 5%, it indicates that the item may not be suitable [28], prompting the researchers to decide whether to remove the item or consider combining it with other indicators.

When the average score of the item deviated by more than ± 1.5 from the mean score of the entire scale, it indicates that the item's average value is either too high or too low [27]. When the standard deviation of an item's score was less than 0.5, it indicates low discrimination. Additionally, an absolute value of the skewness coefficient close to 2 indicates excessive skewness [28,29].

Table 1 indicates that none of the 760 questionnaires had missing responses. As such, no items were removed. From the range of ±1.5 standard deviations from the mean of the entire questionnaire [28], the mean of item 13 (3.37), item 19 (3.41), and item 20 (3.44) was <3.45. After consultation with experts, it was decided to retain items 13, 19, and 20, as their scores for standard deviation, skewness, and kurtosis coefficients met the acceptable criteria. Consequently, all 30 items were tested and analyzed for validity.

Table 1. Observation summary of the omission test (missing data, mean, standard deviation, skewness, and kurtosis coefficient of each item).

Item	Missing Data	Mean	S.D.	Skewness	Kurtosis
Q1	0.0%	4.02	0.94	−0.75	0.36
Q2	0.0%	4.04	0.95	−0.76	0.19
Q3	0.0%	3.86	0.98	−0.56	−0.02
Q4	0.0%	3.86	0.98	−0.55	−0.01
Q5	0.0%	4.05	0.90	−0.67	0.13
Q6	0.0%	3.94	0.95	−0.56	−0.05
Q7	0.0%	3.85	0.94	−0.43	−0.19
Q8	0.0%	3.93	0.94	−0.51	−0.11
Q9	0.0%	4.03	0.91	−0.67	0.13
Q10	0.0%	3.95	0.92	−0.46	−0.28
Q11	0.0%	3.90	0.98	−0.52	−0.27
Q12	0.0%	3.92	0.92	−0.44	−0.28
Q13	0.0%	3.37	1.10	−0.17	−0.47
Q14	0.0%	3.67	0.99	−0.25	−0.36
Q15	0.0%	3.53	1.04	−0.22	−0.28
Q16	0.0%	3.85	0.94	−0.53	0.11
Q17	0.0%	3.84	0.96	−0.46	−0.13
Q18	0.0%	3.74	0.95	−0.29	−0.26
Q19	0.0%	3.41	1.12	−0.31	−0.32
Q20	0.0%	3.44	1.11	−0.30	−0.34
Q21	0.0%	3.71	1.06	−0.48	−0.15
Q22	0.0%	3.68	1.04	−0.49	−0.08
Q23	0.0%	3.53	1.04	−0.30	−0.11
Q24	0.0%	3.48	1.05	−0.27	−0.17
Q25	0.0%	3.38	1.06	−0.20	−0.12
Q26	0.0%	3.81	0.98	−0.49	−0.08
Q27	0.0%	3.58	1.03	−0.24	−0.32
Q28	0.0%	3.97	0.99	−0.62	−0.18
Q29	0.0%	3.98	0.99	−0.66	−0.04
Q30	0.0%	4.02	0.93	−0.65	0.09
Overall		3.78	0.22		
The range of ± 1.5 standard deviations from the mean of the questionnaire				(3.45, 4.11)	

3.2. Survey Validity and Reliability Test Analysis

3.2.1. Extreme Groups Approach (EGA)

The extreme groups approach (EGA), also known as the internal consistency method, was mainly used to test whether certain items in the questionnaire were discriminative. The subjects were divided into a high group and low group according to the total questionnaire score to determine whether a statistically significant difference existed in the average scores of the two groups for each item [30]. Chen & Wang [28] noted that the discrimination and reliability of each item could be assessed when the subjects were grouped by the upper and lower 27% of the total questionnaire scores, with the standard deviation following a normal distribution of 1. The average score of each item of the two extreme groups exhibited a significant difference, thereby reflecting the discriminative power of the items.

An independent samples *t*-test was next used to conduct item analysis, where the scores for each item were summed up and sorted based on high and low scores as the selection criteria for each item. Table 2 indicates that the *t*-values of the high and low

groups of each item exhibited a significant difference level ($p < 0.05$), and all items passed the EGA test, indicating that each item has a degree of discrimination. Therefore, none of the items were removed. All were retained for inclusion in the exploratory factor analysis.

Table 2. Independent samples *t*-test report using the extreme groups approach test.

Items	Levene's Test for Equality of Variances		*t*-Test for Equality of Means	
	F	Sig.	*t*	Sig. (2-Tailed)
Q1	19.32	0.00	−32.23	0.00
Q2	8.98	0.00	−31.64	0.00
Q3	4.81	0.03	−31.68	0.00
Q4	6.88	0.01	−32.73	0.00
Q5	55.71	0.00	−36.50	0.00
Q6	2.65	0.10	−29.89	0.00
Q7	2.51	0.11	−33.12	0.00
Q8	0.60	0.44	−37.38	0.00
Q9	13.24	0.00	−35.73	0.00
Q10	2.34	0.13	−35.94	0.00
Q11	5.58	0.02	−30.66	0.00
Q12	0.14	0.71	−33.56	0.00
Q13	15.95	0.00	−21.78	0.00
Q14	0.01	0.93	−32.67	0.00
Q15	4.77	0.03	−25.39	0.00
Q16	0.00	0.99	−31.30	0.00
Q17	0.01	0.92	−33.28	0.00
Q18	0.16	0.68	−36.83	0.00
Q19	2.69	0.10	−26.16	0.00
Q20	3.98	0.05	−26.65	0.00
Q21	0.19	0.66	−25.98	0.00
Q22	32.85	0.00	−34.33	0.00
Q23	6.39	0.01	−29.14	0.00
Q24	1.64	0.20	−28.11	0.00
Q25	4.67	0.03	−22.72	0.00
Q26	0.05	0.83	−28.33	0.00
Q27	10.56	0.00	−25.43	0.00
Q28	3.24	0.07	−31.26	0.00
Q29	8.48	0.00	−27.52	0.00
Q30	22.65	0.00	−24.16	0.00

In terms of item analysis in Table 3, this study used five indicators: extreme group comparison, item-total correction scores, Cronbach's alpha reliability test, commonality, and factor loading.

Table 3. Project summary sheet.

Item	Extreme Group Comparison Decision Value	Corrected Item-Total Correlation	Cronbach's α	Factor Extraction	Factor Loadings
Q1	−32.23 ***	0.76	0.98	0.89	0.73
Q2	−31.64 ***	0.75	0.98	0.87	0.70
Q3	−31.68 ***	0.77	0.98	0.83	0.66
Q4	−32.73 ***	0.78	0.98	0.78	0.64
Q5	−36.50 ***	0.80	0.98	0.82	0.64
Q6	−29.89 ***	0.76	0.98	0.81	0.77
Q7	−33.12 ***	0.78	0.98	0.78	0.69
Q8	−37.38 ***	0.80	0.98	0.79	0.69
Q9	−35.73 ***	0.80	0.98	0.84	0.70
Q10	−35.94 ***	0.78	0.98	0.83	0.75
Q11	−30.66 ***	0.76	0.98	0.89	0.71

Table 3. *Cont.*

Item	Extreme Group Comparison Decision Value	Corrected Item-Total Correlation	Cronbach's α	Factor Extraction	Factor Loadings
Q12	−33.56 ***	0.79	0.98	0.89	0.66
Q13	−21.78 ***	0.69	0.98	0.86	0.68
Q14	−32.67 ***	0.78	0.98	0.81	0.58
Q15	−25.39 ***	0.74	0.98	0.80	0.53
Q16	−31.30 ***	0.77	0.98	0.86	0.68
Q17	−33.28 ***	0.76	0.98	0.84	0.66
Q18	−36.83 ***	0.83	0.98	0.77	0.51
Q19	−26.16 ***	0.74	0.98	0.82	0.79
Q20	−26.65 ***	0.76	0.98	0.81	0.76
Q21	−25.98 ***	0.75	0.98	0.79	0.64
Q22	−34.33 ***	0.82	0.98	0.85	0.77
Q23	−29.14 ***	0.80	0.98	0.86	0.81
Q24	−28.11 ***	0.78	0.98	0.88	0.85
Q25	−22.72 ***	0.72	0.98	0.84	0.84
Q26	−28.33 ***	0.75	0.98	0.80	0.53
Q27	−25.43 ***	0.71	0.98	0.87	0.70
Q28	−31.26 ***	0.72	0.98	0.79	0.70
Q29	−27.52 ***	0.68	0.98	0.81	0.74
Q30	−24.16 ***	0.69	0.98	0.79	0.73
Judgment Criteria	>3.0	>0.3	0.98	>0.20	>0.50

*** $p <$ Correlation is significant at the 0.001 level (two-tailed).

The judgment criteria for evaluating the questionnaire items were as follows: the decision value must be >3.0 [28,31], and the item-total correlation coefficient must be >0.3 [28,31], ranging from 0.68 to 0.83 for the survey items. Regarding commonality, the extraction must be >0.20 [28,30], indicating a close relationship between the item and the common factor. Additionally, the factor loading must be >0.50 [28,32]; the highest factor loading was 0.85. Overall, highly positive and strong homogeneity was observed among all the subscales.

3.2.2. Exploratory Factor Analysis (EFA)

The following discusses the results of the exploratory graphical analysis (EGA) and the use of exploratory factor analysis (EFA), with the primary purpose of establishing the construct validity of the questionnaire. Based on the absolute value of factor loadings, each item and common factor were determined to reduce the more complex multivariate structure. Items with lower absolute values of factor loadings were to be subsequently deleted.

One way to test the net correlation coefficient between variables by the quantitative test of sampling suitability is the Kaiser–Meyer–Olkin test of sampling adequacy (KMO). The other is to use Bartlett's test of sphericity (BTS) to correlate whether the correlation coefficient in the matrix is significantly higher than 0. The closer the KMO value is to 1, the lower the net correlation coefficient between the variables in the questionnaire, thus suggesting that extracting common factors will be more effective when conducting EFA [28]. If the KMO value is less than 0.5, it indicates that factor analysis is not suitable, whereas values between 0.8 and 0.9 indicate suitability, and values above 0.9 indicate high suitability [32]. For this purpose, the single-factor raw load allowance judgment of principal component analysis (PCA) was used. When extracting factors, the PCA and Varimax orthogonal rotation were applied to assess the convergence of the questionnaire. Factors with eigenvalues greater than 1.0 were retained, resulting in the extraction of eight factors. Each item factor loading was required to be greater than 0.50 to be used as the criterion for constructing validity. Items with low absolute factor loadings were removed. When using factor analysis to remove unsuitable items, two common criteria were applied:

(1) the factor loading in the "component matrix" table is less than 0.4, and (2) the squared factor loading, with the criterion being that communality is less than 0.3 [27].

The results of this study show that the KMO measure of sampling adequacy for the questionnaire was 0.974 (KMO > 0.5), and the BTS had a *p*-value of 0.000 ($p < 0.05$), indicating a significant difference. The approximate chi-square of BTS was 24,041.284, and the corresponding probability *p*-value was close to 0, leading to the rejection of the null hypothesis. This suggests that the correlation coefficient matrix differs significantly from the identity matrix. Overall, the data were found to be suitable for EFA, as the KMO analysis yielded a higher index and the BTS score was statistically significant. The KMO and BTS results indicate that the data satisfy the psychometric criteria for factory analysis. These two tests were used to measure the factorability of the intercorrelation matrix, and the results revealed that the factor model was appropriate (Table 4).

Table 4. KMO and BTS.

KMO and Bartlett's Test		
Kaiser–Meyer–Olkin measure of sampling adequacy		0.974
	Approx. chi-square	24,041.284
	df	435
	Sig.	0.000

The initial solution generated after factor analysis indicates the common significance of all variables. PCA was used to extract the eigenvalues of all 30 factors of the questionnaire. The initial commonality of the variables was set to 1 (the original normalized anomaly was 1); however, since the number of factors was smaller than the original number of variables, not all the eigenvalues could be extracted. The effectiveness of this factor extraction was concluded to be generally acceptable. The factor loadings of the 30 items on the subscales range from 0.51 to 0.85 (as shown in Table 3). Based on this, these items were sufficiently qualified to be included in the scale. The standard Pearson correlation coefficient of the total score of this questionnaire is greater than 0.3 (Table 5), indicating statistically significant correlations among the questionnaire subscales.

Table 5. Inter-factor correlation matrix (person) summary.

Subscales	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Dimension 1. The application of bilingual teaching for teachers	1							
Dimension 2. The application of multimodal teaching by teachers	0.840 **	1						
Dimension 3. Bilingual teaching strategies provided by teachers for students with difficulty learning	0.806 **	0.850 **	1					
Dimension 4. Student's understanding and application of bilingual curriculum content	0.713 **	0.734 **	0.742 **	1				
Dimension 5. Strategies for students to deal with learning difficulties	0.636 **	0.657 **	0.678 **	0.704 **	1			
Dimension 7. Contributions to students' language abilities	0.628 **	0.617 **	0.633 **	0.743 **	0.687 **	1		

Table 5. *Cont.*

Subscales	1	2	3	4	5	6	7	8
Dimension 6. Students' acceptance of the implementation of bilingual curriculum policy	0.674 **	0.670 **	0.675 **	0.800 **	0.683 **	0.876 **	1	.
Dimension 8. The establishment of a bilingual environment in schools	0.771 **	0.726 **	0.746 **	0.715 **	0.701 **	0.692 **	0.671 **	1

** $p <$ Correlation is significant at the 0.01 level (two-tailed).

The eigenvalue of the first factor was found to be at a higher inherent value from the scree plot (see Figure 1), indicating that this factor plays a major role in explaining the variance of the original variables. As the scree plot gradually flattens, the eigenvalues of the factors below the ninth become smaller, indicating that these factors contribute less to explaining the original variables. Therefore, the extraction of eight factors is considered appropriate.

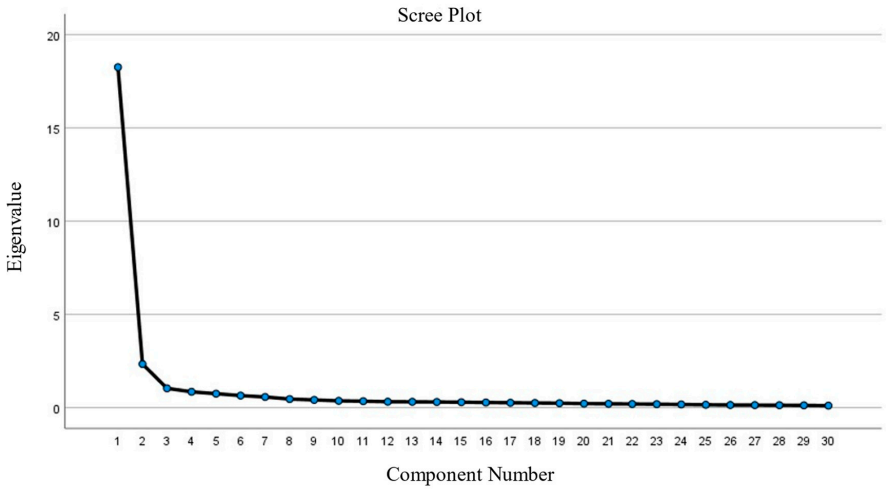


Figure 1. Scree plot for the exploratory factor analysis plot.

The rotated component matrix in Table 6 indicates that the first-factor analysis extracted corresponds to the eighth dimension, with loading values ranging from 0.51 to 0.64, across four items (Q18, Q19, Q20, Q21). These items represent the acceptance of the implementation of bilingual curriculum policy for students, which explains 22.34% of the variance. The loading values of the second factor range from 0.77 to 0.85, also encompassing four items (Q22, Q23, Q24, Q25) that represent contributions to students' language abilities, which explains 18.52% of the variance. The loading values of the third factor range from 0.64 to 0.77 across three items (Q5, Q6, Q7) representing the application of multimodal teaching application by teachers, and it explains 10.23% of the variance. The loading values of the fourth factor range from 0.69 to 0.75 across three items (Q8, Q9, Q10) that represent bilingual teaching strategies provided by teachers for students with difficulty learning, and its explained variance is 9.24%. The loading values of the fifth factor range from 0.53 to 0.74, with five items (Q26, Q27, Q28, Q29, Q30) representing establishing a bilingual environment in schools, and its explained variance is 6.67%. The loading values of the sixth factor range from 0.64 to 0.73, with four items (Q1, Q2, Q3, Q4) representing the application of bilingual teaching for teachers, which explains 6.65% of the variance. The loading values of the seventh factor range from 0.53 to 0.68, with three items (Q15, Q16, Q17) representing strategies for students to deal with learning difficulties, and its explained variance is 5.00%. The loading values of the eighth factor range from 0.58 to 0.71 across four items (Q11, Q12, Q13, Q14) representing students' understanding and application of bilingual curriculum

contents, and its explained variance is 4.32%. The cumulative explained total variance was 82.97%, and the proportion of variance explained by the factors was higher than the proportion of error variance, indicating that "Student Perspectives on the Acceptance of Promoting Bilingual Education Questionnaire" has good construct validity.

Table 6. Principal component analysis (with Varimax rotation) loadings of bilingual teaching (N = 143).

Items	Factor Loadings	Rotated Component Matrix							
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
1. Teachers use bilingual teaching in class.	0.73						0.73		
2. Teachers use bilingual textbooks or slide. presentations in class.	0.70						0.70		
3. Teachers provide bilingual worksheets or study checklists in class.	0.66						0.66		
4. Teachers lead students to engage in bilingual activities or games in class.	0.64						0.64		
5. Teachers use videos or pictures to help me understand the curriculum content in bilingual class.	0.64			0.64					
6. Teachers use body movements (including voices and expressions) to help me understand the curriculum content in bilingual class.	0.77			0.77					
7. Teachers use physical teaching aids to help me understand the curriculum content in bilingual class.	0.69			0.69					
8. When I don't understand the content taught in English, the teacher helps me understand with simpler English.	0.69				0.69				
9. When I misunderstand the teacher's English instructions or make a mistake, the teacher helps me understand in Chinese.	0.70				0.70				
10. When I misunderstand the teacher's English instructions or make a mistake, the teacher lets me figure out the problem with other expressions (e.g., movements or sounds).	0.75				0.75				
11. I can understand the contents of bilingual instruction by the teacher.	0.71								0.71
12. I can follow the bilingual instruction of teacher.	0.66								0.66
13. In bilingual courses, students occasionally communicate with each other bilingually.	0.68								0.68
14. In bilingual courses, bilingual discussions take place between teachers and classmates.	0.58								0.58
15. When I don't understand the content of the teacher's bilingual instruction, I proactively ask the teacher for help.	0.53							0.53	
16. When I don't understand the content of the teacher's bilingual instruction, I proactively ask my classmates for help or see what they are doing.	0.68							0.68	
17. When I don't understand the teacher's bilingual instruction, my classmates help me understand.	0.66							0.66	
28. After taking bilingual classes, I learned the content knowledge.	0.51	0.51							
19. After taking bilingual classes, my interest in learning English has grown.	0.79	0.79							
20. After taking bilingual classes, I am more willing to use English in my daily life.	0.76	0.76							
21. I don't mind participating in the bilingual course.	0.64	0.64							
22. The school's bilingual course content has contributed to my English listening abilities.	0.77		0.77						
23. The school's bilingual course content has contributed to my English speaking abilities.	0.81		0.81						
24. The school's bilingual course content has contributed to my English reading abilities.	0.85		0.85						
25. The school's bilingual course content has contributed to my English writing abilities.	0.84		0.84						
26. In addition to this bilingual course, other teachers also teach bilingually.	0.53					0.53			
27. At school, other teachers greet me and give instructions in English.	0.70					0.70			
28. I hear bilingual speeches from the principal or department head during public occasions (e.g., morning meetings or school anniversary celebrations).	0.70					0.70			
29. I hear bilingual announcements in school.	0.74					0.74			
30. The signage, slogans, and posters at school are designed bilingually.	0.73					0.73			
Eigenvalue		6.70	5.56	3.07	2.78	2.00	2.00	1.50	1.30
Percentage of variance (%)		22.34%	18.52%	10.23%	9.24%	6.67%	6.65%	5.00%	4.32%
Cumulative %		22.34%	40.86%	51.10%	60.33%	67.00%	73.65%	78.65%	82.97%

Note: extraction method: principal component analysis. Rotation method: Varimax with Kaiser normalization. Eigenvalue > 1.

3.3. Reliability Test

After factor analysis, the "Student Perspectives on the Acceptance of Promoting Bilingual Education Questionnaire" in this study was tested for the reliability of its subscales. In the reliability analysis process, Cronbach's alpha coefficient was adopted to evaluate the reliability, consistency, and stability of the pre-test questionnaire in this study [28]. The higher the coefficient, the better the reliability.

In terms of the scale's reliability, the Cronbach's alpha values for each measurement aspect are presented in Table 7. All eight factors yielded good reliability estimates ranging from 0.88 to 0.95. The overall Cronbach's alpha for the entire construct was 0.98, which is greater than 0.7, indicating that the reliability of each questionnaire is still acceptable [33]. Thus, all the items of the pre-test survey were retained, based on the compiled formal scale.

Table 7. Summary of analysis results of reliability statistics for factor-based scales.

Dimensions	No. of Items	Cronbach's Alpha	Overall Cronbach's Alpha
Dimension 1: Q1-Q4 The application of bilingual teaching for teachers	4	0.92	0.98
Dimension 2: Q5-Q7 The application of multimodal teaching by teachers	3	0.91	
Dimension 3: Q8-Q10 Bilingual teaching strategies provided by teachers for students with difficulty learning	3	0.92	
Dimension 4: Q11-Q14 Student's understanding and application of bilingual curriculum content	4	0.88	
Dimension 5: Q15-Q17 Strategies for students to deal with learning difficulties	3	0.88	
Dimension 6: Q18-Q21 Students' acceptance of the implementation of bilingual curriculum policy	4	0.91	
Dimension 7: Q22-Q25 Contributions to students' language abilities	4	0.95	
Dimension 8: Q26-Q30 The establishment of a bilingual environment in schools	5	0.89	

4. Conclusions and Recommendations

4.1. Conclusions

The "Student Perspectives on the Acceptance of Promoting Bilingual Education Questionnaire" used in this study is composed of 30 items and divided into eight dimensions: (1) the application of bilingual teaching for teachers, (2) the application of multimodal teaching by teachers, (3) bilingual teaching strategies provided by teachers for students with learning difficulty, (4) students' understanding and application of bilingual curriculum content, (5) strategies for students to deal with learning difficulties, (6) students' acceptance of the implementation of the bilingual curriculum policy, (7) contributions to students' language abilities, and (8) the establishment of a bilingual environment in schools. The results of this research align with the FERTILE model advocated by Lin [15], which emphasizes the following principles: Dimensions 1 and 2 are consistent with the fifth principle relating to principles of instructional strategies for class teaching. Dimensions 3 and 5 are consistent with the sixth principle, which states that students should be cared for by analyzing their learning needs and applying differentiated instruction during bilingual teaching. Dimension 4 aligns with the fourth principle: "Sufficient time must be given to promote bilingual education". Dimension 6 is consistent with the third principle on the effect of role modeling

in the school. Dimension 7 aligns with the first principle, which states that "the promotion of bilingual education requires flexibility". Finally, Dimension 8 is consistent with both the second principle, "Bilingualism promotion must be based on the establishment of the environment", and the seventh principle (to engage with stakeholders).

In terms of content validity, the questionnaire was reviewed by experts and English teachers with backgrounds in language education, and modifications were made according to their feedback. Additionally, validity was tested by descriptive statistics, item analysis, and exploratory factor analysis to examine the construct validity and internal consistency. The results of this study indicate that the assessment was comprehensive, established, and integrated in several dimensions, with acceptable reliability and validity.

The average score of the questionnaire was ± 1.5, and the range of standard deviation was (3.45, 4.11), but the average of the 30 items was 3.78. Subsequently, through item analysis, the total scores of the samples were divided into the highest 27% and lowest 27% as two groups. The 30 items were then compared to determine their discriminative power. It was found that the decision values of all the items all met the standard for discriminative power as assessed by the extreme groups method.

Furthermore, a validity test was carried out to analyze the internal consistency of each dimension. Principal component analysis (PCA) with Varimax rotation and Kaiser normalization was performed using exploratory factor analysis (EFA), resulting in factor loadings ranging from 0.51 to 0.85. The cumulative variance explained by the eight factors was 82.97%, with the variance contributions of each dimension as follows: Dimension 1 accounted for 22.34%, Dimension 2 for 18.52%, Dimension 3 for 10.23%, Dimension 4 for 9.24%, Dimension 5 for 6.67%, Dimension 6 for 6.65%, Dimension 7 for 5.00%, and Dimension 8 for 4.32%.

Lastly, the Cronbach's alpha value for the overall questionnaire was 0.98, which is greater than 0.7 [33]. This high reliability indicates that the 30 items in the questionnaire provide a robust standard for interpreting and inspecting various dimensions: (1) Dimensions 1, 2, and 3 emphasize the teacher's teaching practices and applications, (2) Dimensions 4, 5, and 7 focus on students' learning and encountered difficulties, and (3) Dimensions 6 and 8 emphasize policy establishment and the bilingual environment [15]. The findings obtained from these students who received bilingual learning can offer insights on other student populations in Taiwan and other countries with similar contexts.

In summary, the purpose of this research was to develop a questionnaire suitable for investigating the "Student Perspectives on the Acceptance of Promoting Bilingual Education Questionnaire", which is a tool developed in accordance with the current situation and the needs of the Bilingual Teaching Policy in Taiwan, especially those of junior high schools located in Taipei City. It aims to serve as a resource for researchers. Additionally, the research explores correlations with other variables, such as the application and impact effectiveness of bilingual teaching.

The "Student Perspectives on the Acceptance of Promoting Bilingual Education Questionnaire" is based on rigorous logical reasoning and coherent theoretical discussion, providing a solid theoretical foundation. The development of a standardized mechanism has substantial positive benefits. Firstly, bilingual teachers can achieve a standard quality of teaching effectiveness by following scientific management and operating methods to improve students' bilingual learning performance. Secondly, teachers can use this assessment tool to focus more effectively on evaluating and improving students' bilingual learning within a limited timeframe. The assessment can define the orientation of individual bilingual learning and teaching projects based on actual implementation and evaluation. Additionally, bilingual teachers can collect information from multiple perspectives, apply customized interventions to address specific problems, and consider individual needs to improve teaching service satisfaction and expectations.

4.2. Recommendations and Limitations

Bilingual teachers are suggested to regularly promote the "Student Perspectives on the Acceptance of Promoting Bilingual Education Questionnaire" as a tool for individual teaching evaluation and observation. The more effectively teachers utilize this assessment, the better it will contribute to improving the overall quality control of teaching and the comprehensive development of the school [24]. It is also suggested to provide situational training opportunities that invite experts to share experiences and engage in bilingual teaching-related empowerment activities or to hold short-term training sessions. Once a teacher adopts the concept of bilingual teaching, they should immediately assess students' current learning situations and objectives. Following this assessment, the teacher should then develop and execute an activity plan. The next step involves implementing the plan and identifying any issues. Finally, based on identified gaps, the teacher should arrange corrective measures to improve the effectiveness of bilingual learning.

It is suggested that future research collect at least 1000 additional samples to test the suitability of the factor structure of this questionnaire using confirmatory factor analysis (CFA) and conduct validity studies with different groups of subjects. To ensure comprehensive coverage and appropriateness, the total number of questionnaire items should ideally be three to five times the number of constructs being measured [31]. Furthermore, qualitative in-depth interviews can be used to verify the causal relationship between variables (Dimension 1 to Dimension 8), making the study results more practical and valuable.

Given that the current study's samples are all from junior high schools, future research can broaden its sample base to include primary school students, as well as those in senior high schools. This would allow for a more comprehensive analysis and generalization of the findings. Internationally, various studies on bilingual education have highlighted its effectiveness and raised awareness of potential challenges. However, research on this topic in Taiwan has been relatively sparse. This gap presents a valuable opportunity for researchers in Taiwan to conduct further studies, thereby enhancing the understanding and implementation of bilingual teaching practices.

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References

1. National Development Council. Blueprint for Developing Taiwan into a Bilingual Nation by 2030. 2018. Available online: https://www.ey.gov.tw/File/9D8184D696681795?A=C (accessed on 13 August 2024).
2. Wang, Y.-P.; Lin, T.-B. The implementation of bilingual education: Reflections on Taiwan's bilingual national policy with the experience of Singapore and Canada. *Second. Educ.* **2021**, *72*, 18–31. [CrossRef]
3. Canagarajah, S. *Translingual Practice: Global Englishes and Cosmopolitan Relations*; Routledge: London, UK, 2012. [CrossRef]
4. Creese, A.; Blackledge, A. Translanguaging in the bilingual classroom: A pedagogy for learning and teaching? *Mod. Lang. J.* **2010**, *94*, 103–115. [CrossRef]

5. Garcia, O.; Sylvan, C.E. Pedagogies and practices in multilingual classrooms: Singularities in pluralities. *Mod. Lang. J.* **2011**, *95*, 385–400. [CrossRef]
6. Hélot, C. Children's literature in the multilingual classroom: Developing multilingual literacy acquisition. In *Language Policy for the Multilingual Classroom. Pedagogy of the Possible*; Hélot, C., Laire, M.Ó., Eds.; Short Run Press: Bristol, UK, 2011; pp. 42–65.
7. García, O.; Baetens Beardsmore, H. *Bilingual Education in the 21st Century: A Global Perspective*; Wiley-Blackwell: Oxford, UK, 2009.
8. Kirkpatrick, R.; Bui, T.T.N. Introduction: The challenges for English education policies in Asia. In *English Language Education Policy in Asia*; Kirkpatrick, R., Ed.; Springer: Berlin/Heidelberg, Germany, 2016; pp. 1–23. [CrossRef]
9. Marian, V.; Shook, A.; Schroeder, S.R. Bilingual Two-Way Immersion Programs Benefit Academic Achievement. *Biling. Res. J.* **2013**, *36*, 167–186. [CrossRef]
10. Irby, B.J.; Tong, F.; Lara-Alecio, R.; Mathes, P.G.; Acosta, S.; Guerrero, C. Quality of instruction, language of instruction, and Spanish-speaking English language learners' performance on a state reading achievement test. *TABE* **2010**, *12*, 1–42.
11. Slavin, R.E.; Madden, N.A.; Calderón, M.; Chamberlain, A.; Hennessy, M. Reading and language outcomes of a multiyear randomized evaluation of transitional bilingual education. *Educ. Eval. Policy Anal.* **2011**, *33*, 47–58. [CrossRef]
12. Lasagabaster, D.; de Zarobe, Y.R. (Eds.) *CLIL in Spain: Implementation, Results and Teacher Training*; Cambridge Scholars Publishing: Newcastle upon Tyne, UK, 2010.
13. Mearns, T.; Van Kampen, E.; Admiraal, W. CLIL in the Netherlands: Three decades of innovation and development. In *Routledge Handbook of Content and Language Integrated Learning*; Banegas, D., Zappa-Hollman, S., Eds.; Routledge: London, UK, 2023; pp. 403–418.
14. Nikula, T.; Skinnari, K.; Mård-Miettinen, K. Diversity in CLIL as experienced by Finnish CLIL teachers and students: Matters of equality and equity. *Int. J. Biling. Educ. Biling.* **2023**, *26*, 1066–1079. [CrossRef]
15. Lin, T.-B. Constructing the "FERTILE" bilingual model in Taiwan: The status quo and future development in secondary education. *Second. Educ.* **2021**, *72*, 6–17. [CrossRef]
16. Krashen, S.D. *Principles and Practice in Second Language Acquisition*, 1st ed.; Language Teaching Methodology Series; Pergamon: Oxford, UK; New York, NY, USA, 1982.
17. Gass, S.M. *Input, Interaction, and the Second Language Learner*, 1st ed.; Routledge: Abingdon, UK, 2013. [CrossRef]
18. Long, M.H. The role of the linguistic environment in second language acquisition. In *Handbook of Second Language Acquisition*; Ritchie, W.C., Bhatia, T.K., Eds.; Academic Press: New York, NY, USA, 1996; pp. 413–468.
19. Tsai, P. The Implementation of Bilingual Education in Taiwan: A Case Study of Two Junior High Schools with a Bilingual Curriculum in Taipei City Using the FERTILE Model. *Educ. Sci.* **2024**, *14*, 887. [CrossRef]
20. Lin, T.-B. The future of bilingual education in Taiwan: Constructing a local model. *Taiwan Educ. Rev. Mon.* **2020**, *9*, 8–13.
21. Wang, L.-Y. An Examination on the Planning and Practice of Bilingual Education in Primary and Secondary Schools in Taiwan. *Educ. Sci.* **2024**, *14*, 1095. [CrossRef]
22. Yeh, J.-L.; Weng, F.-Y. Challenges of bilingual education promotion and suggestions for supporting measures. *Taiwan Educ. Rev.* **2021**, *10*, 19–26.
23. Lin, T.-B.; Wu, C.-W. Exploring challenges and responses of implementing bilingual education in public junior high schools: From policy to practices. *J. Educ. Stud.* **2021**, *321*, 30–42. [CrossRef]
24. Lin, T.-B. Taiwanese basic education under bilingual nation policy: The challenges and opportunities of enhancing the national competitiveness. In *New Generation, New Demand: The Challenges to the Educational Development in Taiwan*; Huang, K.-H., Ed.; The Professor Huang Kun-huei Education Foundation: Taipei, Taiwan, 2020; pp. 453–470.
25. De Vellies, R.F. *Scale Development Theory and Applications*; SAGE: Newcastle upon Tyne, UK, 1991.
26. Chiou, H.J. *Quantitative Research Methods II: Statistical Principles and Analytic Techniques*; Yeh Book: Taipei, Taiwan, 2005.
27. Chiou, H.J. *Quantification Research and Statistics Analysis*; Wunan Book: Taipei, Taiwan, 2006.
28. Chen, K.Y.; Wang, C.H. *Advanced Statistical Analysis Using SPSS and Amos*; Wunan Book: Taipei, Taiwan, 2010.
29. Field, A. *Discovering Statistics Using SPSS*; Sage: London, UK, 2009.
30. Wu, M.L.; Tu, J.T. *SPSS & the Application and Analysis of Statistics*; Wunan Book: Taipei, Taiwan, 2006.
31. Wu, M.-L. *SPSS Statistical Application and Practice*; Unalis Corporation: Taipei, Taiwan, 2003.
32. Yen, C.-L.; Cheng, C.-P. *Statistics Guide for Thesis Writers: Statistics for Dummies*; Wunan Book: Taipei, Taiwan, 2016.
33. Nunnally, J.C. *Psychometric Theory*, 2nd ed.; McGraw-Hill: New York, NY, USA, 1978.

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