

## THE INFLUENCE OF THE BALINESE PHONOLOGICAL SYSTEM ON EFL SOUND ACQUISITION

I Ketut Wardana, Putu Sri Astuti

Universitas Mahasaraswati Denpasar

[ketutwardana71@unmas.ac.id](mailto:ketutwardana71@unmas.ac.id), [sriastuti.unmas@gmail.com](mailto:sriastuti.unmas@gmail.com)

### ABSTRACT

More evidence is needed to determine if English language sounds are influenced by Balinese EFL students. Therefore, this study attempted to examine the dominance of tonal systems in English and Balinese using dual-coding theory. This study used a qualitative approach to describe the English language of Balinese-speaking students as a segmental category. This study included 76 English students from Denpasar. The instruments consisted of a 65 English word list, a picture list, and ten sentences. The articulatory phonetic and referential techniques were used to classify each data set. Accordingly, the students activated the English system more independently but managed to translate it phonetically into Balinese. The phonetic translation, on the other hand, can be pure English, mixed Balinese, and English, or simply pure Balinese. This tendency is influenced by students' phonological awareness, learning experience, and daily practice. According to the results of this study, the four levels of English pronunciation by students are transcription, perception, phonological process, and phonetic translation. At the level of perception, the Balinese sound system is activated in English. This study suggests that English learners and teachers in Bali should use explicit learning to reduce pronunciation errors.

**Keywords:** bilingual, explicit learning, phonetic representation

### INTRODUCTION

Inappropriate English pronunciation by students of all levels of education in Bali does not appear to be a prominent and unique issue that needs investigation, as some scholars believe the errors are a natural process of bilingual learning and need no further discussion. However, examining the study of the processing of speech sounds provides not only an overview of the natural truth of sounds but also a scientific perspective on the analysis of mental sounds. The articulation

mechanism of English and Balinese speech sounds is almost identical. Some consonants like /f/ and /v/ as well as the consonant group /sp/ do not correspond to Balinese orthography. The structure of the English phonetic unit violates spelling uniformity. Orthography in English is not the phonetic translation of the language.

The inconsistency between English spelling and its phonetic translation confuses Balinese students. Sound transmission, cognition, mental phonology, and cognition

can all be involved in encoding the speech sound. The visual and auditory sensory systems provide information from letters and speech sounds. In addition, by interpreting wordings and meanings, the system activates the coding system of two different languages. The coding sounds in bilingual learning come from the dual language system; Mother tongue (L1) and target language (L2). Sensitizing two language systems controls the mental process of sound from underlying form to derived form during the coding process by employing sound modification and representation (Adnyani & Pastika, 2016). The phonetic translation, which involves two phonetic languages, is the final stage of encoding the written symbols.

Mispronunciation of English by foreign students is caused by linguistic, psycholinguistic or neurolinguistic problems (Amengual & Simonet (2019); Adnyani et al., (2018); Buckingham & Christman (2008). According to Vihman (2002) mispronunciation of L2 by the L1 speaker shows the influence of L1, learning experience, and habit formation as part of explicit learning Direct learning Indirect learning refers to the acquisition of knowledge about the sound structure of

language through unconscious learning while the baby is still in the womb (Vihman, 2002) Furthermore, according to Simonet (2016), conception and experience empower language learners to produce near-native pronunciation. Among the findings of foreign language research and learning models, however, the emphasis is on sound coding systems. Bilingual English learning by Balinese students requires more empirical study and scientific evidence.

The articulation of English sound by Balinese learners who are proficient in their native language involves not only comparative cognition between two different language systems but also the expectation of how to balance the system (Flege & Bohn, 2021). The dominance of the L1 language system over the L2 articulation leads to phonemic contrasts. This mastery occurs due to the information transmission process. The transference ends in a complicated perceptual mechanism (Dragger, 2010). The inaccuracy of articulation can lead to confusion and misunderstanding. Balinese students produce the imprecise articulation of English in three ways (Wardana, 2014), including (1) letter-based articulation (/tired/ [tired]), (2) direct interpretation of sounds

(/massage /msa/ [masas] ) and (3) incorrect phonological rules (has /hz/ [hs]).

In the process of bilingual phonology, the sound system of L1 influences the phonological representation of L2. Therefore, the phonetic representation of two different languages describes the articulatory or conceptual phenomenon of two systems. The process of alteration may occur through substitution, deletion, insertion, or addition. There is an insertion of vowel /ə/ between the consonant cluster /s/ and /p/ in the initial position as in the sound of /spi:k/. So Balinese learners tend to say [sə'pɪk], or consonant cluster of /dʒt/ in medial position as /veɪdʒtəbl/ released as [vejətɛɪbəl], or /help/ becomes [heləp]. The phenomenon triggers some questions about the insertion /ə/ in the middle position of words. The insertion is a conceptual phenomenon that can follow the phonological rules generalization (Odden, 2005). Balinese sound system does not recognize the cluster of /sp/, /bl/, and /lp/, so there is a sound simplification by inserting /ə/. So, a specific coding theory can solve the questions or the phenomenon.

From the language learning point of view, phonological awareness and habit formation may result in the appropriate

English pronunciation (Wardana, 2014). Phonological awareness is crucial for constructing conceptual sounds, so the students recognize the sound system of the target language. Explicit learning may contribute a big impact on sound pattern formation. So, the activation of L2 achieves accurate goals. Balancing the interference of L1 on L2 requires a learning strategy. Phonological awareness may enable students to identify, differentiate, and implement phonetic realization correctly (Galles & Bosch, 2005). The physiology of articulation should be at an earlier age before the sound physiology of L1 does not dominate (Simonet, 2016). By communication habit formation, the movement of articulators seems unconsciously natural as L2.. The research problem of the study is “What type of English phonological alteration errors do Balinese students produce?”

Considering the phenomenon, this study aims to describe any types of English phonological alteration errors produced by Balinese students. Furthermore, this study examines the interference of the sound systems of L1 and L2 in bilingual learning. Another objective of the study is to describe how the dual coding theory examines the domination of the L1 sound system over L2

word sound processing. The role of dual coding theory describes the dominance of two different language systems. The combination of phonological theory and bilingual learning theory as the basic concept of dual coding theory may provide evidence of existing articulation phenomena of English by Balinese students. The phonological theory describes the articulatory phenomenon of both languages (Schane, 1973). Meanwhile, the dual coding theory may provide information on how the sound system activates L1 into L2 simultaneously, so the effective strategy in bilingual learning may result in better achievement.

The majority of empirical study in bilingualism supports the insight that the system of two different languages in bilingual learning always seems integrated. Processing the two languages by bilingual speakers certainly sounds non-selective (Schwartz, 2020). The study which investigates visual and auditory words recognition in bilingualism reveals that lexicons of the two languages locate in the same brain area. The retrieval process in reading or listening comprehension does not go directly to the language selection but cultivates those words from two languages

simultaneously. The individuals who learn their second language in the adult stage often face some phenomenon of (1) the new language category (the sound only exists in L2); (2) voice contrary or phonological distinction in L2 or new articulations; and (3) habitual perceptions, meaning the L1 of the bilingual speakers interact with L2. Interactions between two languages activate the two systems based on the modern theory of phonology and language learning model (Flege & Bohn, 2021).

The objective of the phonetic and phonological study in bilingualism is to explore the new category formation in speech production based on the habitual and perceptual strategy; save and retrieve (Bybee, 2001; Harley, 2001). According to some notions from different schools, like Simonet (2016); Polinsky & Scontras (2019); Dragger (2010), phonological awareness consists of category determination one of which as phoneme and sequence of rules in the speech sound based on the status and system. In line with this statement, Balinese bilingual learners who learn English should acknowledge the language category of both languages. The awareness of the phonological category allows the students to pronounce every

distinctive phoneme accurately. The previous chaptered studies have underlined the influence of phonetic and phonological structure in L2. The synthesis of the studies finds the keywords of structure and system from two different languages. Simonet (2016) suggested the difference of acoustic measurements of voiceless plosive sound (/p/, /t/, /k/) in the initial position of Spanish and English words. The phonetic variation for voiceless plosive sound should be aspirated [p<sup>h</sup>, t<sup>h</sup>, c<sup>h</sup>] is not known in Spanish, however, some speakers acknowledge the rules (e.g., Flege & Bohn (2021); Vihman (2002)). It means that the voiceless plosive consonant generally occurs due to interaction across the languages. This rule does not also exist in Balinese sound structure so it might be the same evidence that Balinese learners may articulate the segments as the letter tells.

#### Dual coding system

Some scholars suggest that the mastery of dual system and sound structure have two dependent tracts in phonological learning; implicit and explicit. Implicit learning begins in the prenatal stage, where the baby recognizes the first language, especially the rhythm pattern of the mother's speech (Simonet, 2016). Furthermore, with the

development of phonological skills, the children begin conceptualizing the sound patterns and associate them with meaning from the sound reference. Magloire & Green (1999) suggest that exposure to a unimodal distribution has the effect of reducing discrimination. The process of sound conception enrichment also refers to routines as habit formation known as explicit learning (Flege & Bohn 2021). Some theoretical frameworks support the prominent roles in dual-modality in pronouncing the L2. The dual coding theory supports the role of nonverbal language in activating the systems. According to this theory, individuals process the verbal and visual cues through different lines but independently, heading to learning outputs because the constant verbal and nonverbal language across the languages can strengthen the learning (Clark & Paivio, 1991). Empirical studies found positive shreds of evidence of visual cues like lips shape for L2 articulation learning. PAVIO (1991) attempts to provide equal measurement in verbal and nonverbal processing. Paivio, (1991). suggests that human cognition is uniquely specified for language and objects simultaneously. It means that the language system specifically

relates directly with linguistic input and output in the form of spoken and written language. Meanwhile, simultaneously handle the symbolic function of nonverbal object, occurrence, and behavior. Any representational theory should accommodate dual functionality.

Dual coding theory identifies three types of processing, including (1) representational; direct activation from verbal and nonverbal clues; (2) referential, activation of the verbal system by the nonverbal system or vice versa; (3) associative processing, representation activation in the same verbal or nonverbal system. This theory elaborates on many cognitive phenomena, including mnemonics, problem-solving, learning principles, and language. Dual coding theory provides the significance of spatial ability in intelligence and elaboration of bilingual processing.

Therefore, this study attempts to identify, classify, and elaborate on the phenomenon of two speech sound coding mechanisms. This study assumes that the interference of the sensory system in stimulating the two different language symbols produces different outcomes or phonetic realization. Sound identification focuses on the comparison of two language pronunciations.

The differences are classified into the phonological process in both language systems and this study observes the domination of one language over the other. From the phonological process, this study assumes that L1 influences the phonetic realization of L2 and can be balanced by implicit and explicit learning models.

## **RESEARCH METHODS**

. The population consisted of 95 students who had been learning English since they were 9 years old. The determination of the sample size based on the Slovin model with a margin of error was 5% or 0.05 (Bungin, 2003). Therefore, the samples were 76 students, deliberately collected. The sample consisted of 25 or 33% boys and 51 or 67% girls. 20 students were 18 or 19 years old, 37 students were 20 or 21 years old and 19 students were 22 or 23 years old. The sample was considered sufficiently representative.

The instruments that were utilized to collect the primary data in this study were sixty English word and pictures lists and ten sentences. The students read the words and those sentences and recorded them with a sonny sound recorder. The words, word pictures, and the sentences were constructed containing consonants, consonant clusters,

vowels, and diphthongs in different distributions; in initial, media, and final positions. The student's sound recordings were gathered and classified into types of distortion, segmental alteration, and four factors of misrepresented articulation. All the instruments were validated by expert judges in phoneticians, linguists, and language lecturers. To measure the accurateness of the English sounds production of the students, the acoustic features of the sound recordings were analyzed using PRAAT (Boersma, 2021) to recognize if there were any sound distortion, sound alteration errors, and VOT for aspirated plosive consonants.

The data were analyzed and presented considering the objective of the study, questions of the study, and characteristics of the research approach. The first objective was to describe the level and types of phonological alteration and factors that caused the phonological distortion and alteration. So, all the errors were calculated in form of a percentage, the distribution was tabulated, and the results were presented in graphs. The second objective was supposed to analyze the alteration made by Balinese students and how the alteration might occur in the perspective of generative phonology.

Furthermore, in this section, a new finding was assumed concerning how the dual system theory worked in these cases. The third objective explored how the study revealed the new model to describe how the bilingual learners interpreted the L2 language sound and implemented it into any type of realization. From these objectives, the implicit and explicit types of sound bilingual learning were applied and described for changing the student's problems and obtaining more accurate and better English alteration.

Data were classified and categorized based on the three objectives of the study to demonstrate the existing phenomenon. The first data classification was analyzed to find out the types of phonological errors and factors that cause the errors produced. All the types of errors and the percentage of alterations and distortion factors were calculated to see the percentage by dividing the total number of errors by the total number of errors timed 100. The acoustic features of the sounds were analyzed then phonemically and phonetically transcribed. Furthermore, with this spectrogram of all recorded sounds, the distortion of the consonants or vowels could be recognized from formants, pitch, duration, and

intonation. The findings then were analyzed by dual coding theory to see how the sound language system worked and from the synthesis, a phonological coding system model could be formulated as a new finding of the study. This model was used to guide how implicit and explicit learning can justify the three different stages of the model.

### **FINDINGS AND DISCUSSION**

The data analysis was begun with the comparison of Balinese students' English pronunciation to the native English pronunciation. The comparison of pronunciation can describe phonological phenomenon from the sound structure and system of both different languages. The study analyzed and described the reconstruction of the mental concept of consonants and vowels, the phonological process, the domination of L1 and L2, and factors that caused the distortion and alteration in phonetic points of view. The finding of the study revealed that substitution errors mainly occurred due to the difficulty of implementing the verbal stimuli into phonetic realization.

The students made 228 correct articulations or 30% from 760 students' total answers. The study revealed that the total number of incorrect articulations of English

by 76 Balinese students was 532 or 70% of all data that consisted of 132 or 25% incorrect articulation of fricative consonants, 387 or 73 % incorrect allophones of the voiceless plosive consonant in the initial position, and only 11 or 2% incorrect vowel sound. All incorrect answers were classified into five types of incorrect pronunciation, such as substitution, insertion, addition, deletion, and distortion. There were 188 or 35% substitution, 32 or 6 % deletion, 150 or 28% insertion, 124 or 23% distortion, and 38 or 7% addition. Four factors that affect the errors consist of 128 or 18% overgeneralization, 133 or 25% incorrect rules, 138 or 26% false concepts, and 133 or 25% fossilized distortion.

Diphthong in Balinese can be found in initial and middle position of the words, but only few in final position, /iə/ like /tabiə/ 'pepper', /ai/ as in /sai/ 'often', /au/ as in /sau/ 'fishing net' and [uə] as in /muə/ 'face'. Balinese has mostly monophthong in the final position. This system might interfere with the phonemic coding and phonetic implementation for the target sounds. However, the syllabic system of English as the target language allows diphthong in the final position. The novel articulation direction in English diphthong



may arise from low to high or from high to low vowel, but in Balinese, the direction goes mostly from high to low position. Some Balinese diphthongs that do not match with English diphthongs in final position are /ei/, /əʊ/, /oʊ/, /oi/. So, the Balinese students mostly delete the last vowel to monophthong. So, it becomes /e/, /ə/, and /o/. a monophthong. Some examples of diphthongs that are pronounced as a single vowel, like today /tə'dei/ → [tude] and okay /əʊ'kei/ → [oke]

From the three examples, the articulation of English diphthong /ei/ by Balinese students phonetically reveals theoretical and empirical facts. Theoretically, the Balinese sound system manages the direction of sequences of two vowels that moves from high vowel to low vowel in the final position, like front middle vowel /siə/ 'nine', but this system does not lead the gliding from low to high vowel as /ei/. For this reason, the students simplify diphthong /ei/ by deleting the high back vowel /ɪ/ in the final position. Empirically, the high vowel deletion is influenced by a perceptual formation that affects the mapping phonetic implementation in the brain (Schwartz, 2020). The diphthong /əʊ/ becomes /o/ in

final position, like go /gəʊ/ → [go], know /nəʊ/ → [no]

English diphthong of /əʊ/ phonetically glides from middle and central vowel to high back rounded vowel. However, the Balinese sound system manages the movement of high to middle or low vowels, not from low or middle vowels to high vowels in the final position. Therefore, Balinese students apply their sound system by deleting the final vowel. So, diphthong /əʊ/ becomes monophthong [o]. When articulating /əʊ/, the tongue blade is in a middle and central position and anticipates articulating /ʊ/ by moving the tongue blade backward and arriving in [o] position. Visual stimuli as orthography may affect the sound alteration into phonetic realization. The process of word-finding may interfere with the mental process of phonological processing in bilingual learning. (Flege & Bohn, 2021). Some examples of the alteration of diphthong into monophthong are in the initial and middle positions in the words, like .open /'əʊpən/ → [opən], hope /həʊp/ → [hoʊp], and phone /fəʊn/ → [poun]

The sound system of two different languages for diphthong /əʊ/ in the middle position of words is integrated into one system. The tongue movement from a

middle central position to high back rounded position /əʊ/ is altered by Balinese students into back rounded position /oʊ/. It can be an indicator of phonetic phenomenon and domination of L1. The alteration of [əʊ] for target sound (L2) becomes /oʊ/ because the sound system of L1 allows the rule that /o/ is articulated as [o]. This phenomenon is in line with what (Flege & Bohn, 2021) suggests that the mechanism of word-finding in reading or listening comprehension does not lead to words selection but processes the words from different language simultaneously. The processing of diphthong /əʊ/ in the middle of the words by Balinese students tends to be the domain of conceptual articulation that the articulators may find it easier to articulate the middle back vowel [o] and goes up to articulate /o/ rather than starting it with central middle vowel /ə/.

Consonant cluster in English phonological rules may consists of (1) [+obstruent] and [+obstruent], such as voiceless fricative + voiceless plosive, like /sp/ in speak, /st/ in steal, /sk/ in sky; (2) [+obstruent] and [+sonoran], like /fl/, /fr/, /sl/, /st/, /sn/, /sm/, /pr/, /tr/, /kr/, /pl/, and /kl/. In Balinese, some consonant clusters of /sp/, /st/, dan /sk/ in initial position or /lp/ in

middle position can not be normal so the insertion of /ə/ occurs to simplify the complexity of the articulation. The insertion of /ə/ may occur in the initial, medial, and final position.

The insertion of /ə/ between English obstruent consonant clusters by Balinese students phonetically occurs because the articulators take a longer time to anticipate the coming consonant articulation and the tongue is in the middle and central position [-front, - high, - back]. The Balinese students tend to simplify the complexity of two consonants by inserting the vowel /ə/. The absence of the sound system in L1 for articulating the sound of L2 influences the phonetic realization. In dual coding theory, different sound canal system ends at the junction so the sound simplification is implemented because at the moment the students are articulating /s/, the tongue anticipates the coming articulation of /p/ but it is too long and the insertion of /ə/ occurs.

Deletion

The English regular verb form can be recognized from the bound morpheme -ed that is articulated either /t/, /d/, or /ɪd/ depending on the final consonant. Some verbs that end with voiceless stop /p/, /k/ and voiceless fricative /f/, /s/, /ʃ/ dan /tʃ/ then

the derivational morpheme - ed is added and articulated as /t/. Other verbs that end with voiced stop /b/, /d/, /g/, voiced palatal fricative /dʒ/, and nasal /m/, /n/, /ŋ/ is added with the morpheme - ed and articulated as /d/. However, the English regular verb form that ends with /t/ and /d/ is added with morpheme – ed, and this morpheme is articulated as /ɪd/. The Balinese language does not recognize this kind of morphophonemic process. So, the students articulate the regular verbs based on the orthography or delete the last segment of the consonant cluster.

The deletion of the consonant cluster at the final position of words, like /pt//kt/, /tʃt/, /nt/, /nd/, /ʃt/, /st/, and /md/ by the Balinese students occurs because their language sound system does not allow any consonant cluster occur at the end of words. So, the students simplify the clusters by deleting the final segment. On the other hand, the students tend to pronounce the words as they are written. Referring to dual coding theory (Paivio, 1990), the phonological coding system is concerned with bilingual processing where the L2 underlying form of /t/ and /d/ are deleted in L1 due to the influence of the visual stimuli and the L1 sound system. This phonological process

can be in the form of a phonological rule that the /t/ or /d/ is deleted in the final position.

English sound system manages the phonological process based on the segment neighborhood called assimilation. When the phoneme is in a queue with other phonemes to form morphemes, then the segments simultaneously influence one another and the alteration occurs. The feature of the segment is submitted by another segment by adopting similar phonetic features that appear before or after, such as place or manner of articulation or voicing. The assimilation that occurs by taking the features of the segment before the altered segment is called regressive assimilation and the segment that changes and takes the features of the coming segments is called progressive assimilation. For example, the segment with feature [–voiced] becomes [+voiced] if the segment appears after the [+voiced.] segment. The voiced consonants includes /b/, /d/, /g/, /v/, /z/, /dʒ/, /m/, /n/, /ŋ/, /y/, /w/, /r/, /l/. However, the underlying form /z/ is realized into deriving form /s/ by Balinese speakers who learn or speak English.

The voiceless alveolar fricative /s/ is articulated as voiced /z/when it occurs after

voiced consonants /b, d, g, m, n, v, dʒ). However, in the Balinese sound system, voiceless consonants never change into voiced consonants. So, the underlying form of /z/ is represented as a deriving form of [s]. The phonetic realization of L2 by L1 speakers derives from the strong visual sensory of orthography of L2. It means that /s/ is articulated as [s] in any segmental environment.

Silent consonant sound in English orthography refers to the letters that are not articulated or deleted in a specific position. In English pronunciation, there are letters or combinations of letters that are not mentioned. For example, /b/ in 'subtle', /c/ in 'scissors', /g/ in 'design', 't' in 'listen, /gh/ in 'thought'. Balinese students tend to articulate all letters based on the Balinese sound system or rules. There are some rules for the silent consonant; (1) b is silent in the cluster of /mb/ and bt at the end of words, such as comb, numb, bomb, limb, and debt; (2) d is always silent in the cluster of /dj/: adjective, adjunct, adjacent; (3) /g/ is silent in the spelling of gm or /gn/: phlegm, gnarl, champagne, sign, gnat, gnaw; (4) /h/ is silent in a cluster of /gh/ and in the word-final position: ghost, ghetto, aghast, ghastly, ah, eh, oh.; and (5) k is silent before /n/ in

initial position: kneel, knee, knob, knight, knave, knowledge, knife, knock".

English sound system has a phonetic variation called allophone. One of them is aspirated voiceless plosive consonants. Each voiceless plosive consonant, such as /p/, /t/, /k/ in initial distribution of words becomes aspirated [+aspirated]. Aspirated sounds are the sounds produced with a restriction between the release of closure of stop consonants, like [h] in [p<sup>h</sup>, t<sup>h</sup>, k<sup>h</sup>]. Phonetically, the software of Praat (Boersma, 2021), the delay of periodic time of voicing or voice onset time (VOT) occurs between the moment of the release and plosion. The aspirated voiceless plosive consonants have a longer VOT (Johnson, 2011). It is between 30-40 ms. It means that the longer duration occurs when the closure is released, the voicing begins with the vibrating vocal cord (see Boucher, 2002; Whitfield et al., 2018).

The sentence in the spectrogram that is uttered by an English native speaker requires only 2 seconds and 1 mile second, however, the Balinese students mainly take 2 seconds and 40 miles second. The Balinese sound system does not recognize aspirated voiceless plosive consonants in initial position or allophone, so the students

articulate the aspirated sounds [p<sup>h</sup>, t<sup>h</sup>, k<sup>h</sup>] as the orthography or letters they read or use sound concepts they have in their language. From the perspective of dual coding theory, this phonetic case belongs to the referential category; activating the sound system of L2 by the system of L1 (Clark & Paivio, 1991).

### **Discussion**

The results are discussed according to the types of phonological alteration, dual phonological coding model, and explicit phonological learning. The phonological alteration by Balinese students in coding English speech sound occurs not due to the purely phonetic level but phonemic processing level. Though, in fact, the phonological process can be described as a phonetic phenomenon. Phonetically, many consonants of English were not accurately articulated by Balinese students due to the absence of those consonants in their orthography system. Phonemically, the English segments were altered for articulatory simplification. The types of phonological alteration found in the study include segment substitution, vowel insertion in consonant clusters, vowel and consonant deletion, and consonant addition. The segment substitution is concerned with

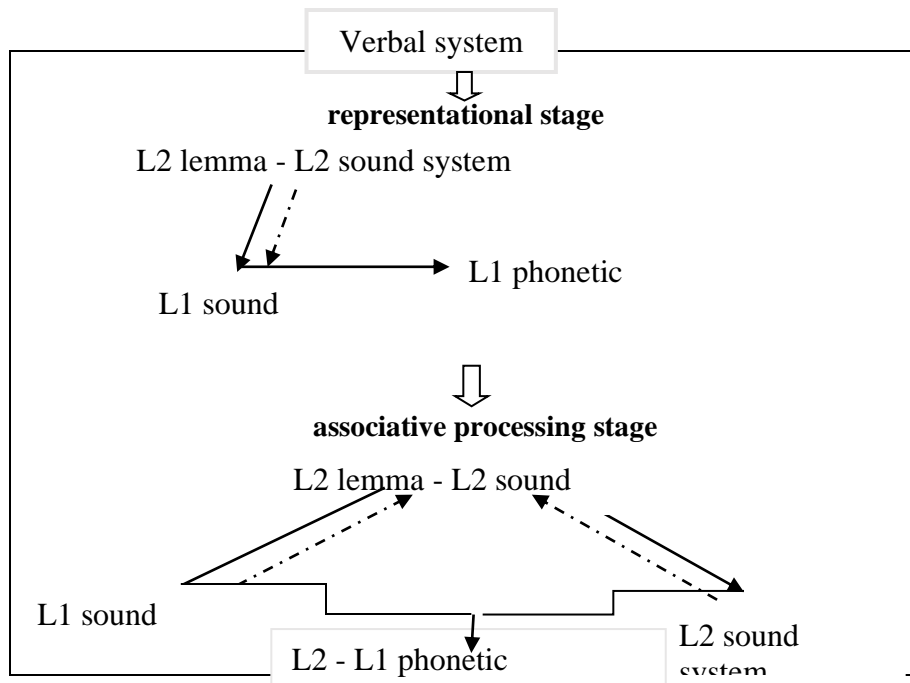
the replacement of one segment with another segment, like diphthong is substituted by monophthong and the voiced alveolar fricative sound is substituted by voiceless sounds.

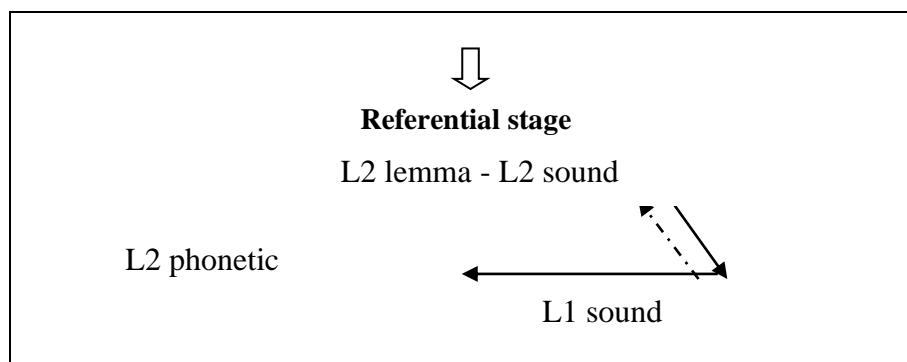
The dual coding theory emphasizes verbal and nonverbal language activation. However, these coding concepts in this theory also support sound phenomena in bilingual learning. This study proved that the two different languages, Balinese as L1 and English as L2, where the Balinese English learners activate the two-coding sound system in three ways. The first tendency is that direct activation of L1 for L2 that occurs either through a strong orthography stimulation of L2 or the absence of orthography of L1 results in L1 phonetic realization. The second tendency is that the two coding systems that are activated simultaneously due to language learning experience, phonological awareness, and language practice (Flege & Bohn, 2021) results in mixed L1 and L2 phonetic realization. The third tendency reveals that the stimuli of the L2 sound system are activated due to phonological awareness and results in L2 phonetic realization. In dual coding theory, Paivio (1990) states that the inputs of the sensory

system connect L1 and L2 systems in representational, referential, and associative processing ways.

Based on the analysis of dual coding theory for the system of two different languages, this study established the sound system mechanism called the phonological coding model. The students activate the system of L2 independently but arrive at the phonetic realization of L1. For example, the Balinese students read the English word sit /sit/ and activate the L1 and pronounce it as [sit]. However, in L2, the tense vowel becomes a lax vowel if it is within consonants while the L1 does not. Mental sound processing occurs from coding, retrieval, and phonetic implementation. Some evidence revealed

that Balinese speaking students in articulating English sounds activate both L1 and L2. However, the phonetic implementation can be purely L1, just purely L2, or mixed L1 and L2. This study suggests that the four levels of students' English articulation involve transmission, perception, phonological process, and phonetic realization. The activation of the sound system of L1 and L2 occurs in the perception level. The perception involves absorption and retrieval of the information and knowledge of both languages. The sound system mechanism in bilingual learning is presented in Figure 1.





**Figure 1.** Balinese-English sound transformation model

Concerning the model established in this study, the L2 phonological learning strategy may depend on the students' L2 phonetic realization level. The representational stage in the bilingual phonology coding model shows that students' English pronunciation is purely affected by the Balinese language. Therefore, the students may adopt elementary explicit learning by acknowledging the phonological awareness of the English speech sound system. At the associative processing stage, Balinese and English systems have affected the students' English pronunciation simultaneously and resulted in inconsistent pronunciation; accurate on some occasions but inaccurate on another occasion. So, an intermediate explicit learning strategy might be worth applying by drilling or rehabilitating some aspects of phonological misconception with articulation practices. Finally, students whose phonetic realization are in the

referential stage. requires the advanced explicit learning strategy to strengthen habit formation.

## CONCLUSION

In the present study, the sound coding system in bilingual learning refers to the phonetic conversion of L2 into L1 and L1 into L2. The system of either language can take control of the other by activating both language systems. The study shows that the most dominant coding category is a referential coding system. The students activate the sound systems of L1 and L2 at the same time. Activation results in incorrect English pronunciation or Balinese pronunciation of English. In conversation, however, the results are still understandable. In this category, the sound of L2 was not in the same sound as L2 because the voiceless and voiced labiodental consonant /f/ and /v/ is articulated as the voiceless and voiced

plosive bilabial consonant /p/ and /b/. The referential coding category included the unbreathed voiceless stop consonants in the initial position of L1 speakers. The influence of L1 led to the inaccuracy of L2. Hence, there was the conversion of diphthong to monophthong. The direction of the low vowel to the high vowel does not exist in L1. This study showed that dual coding theory in bilingual learning enabled L2 activation but realized L1 outcomes. This study suggests that students and teachers apply explicit learning to the form of communication habits in English by activating L2 to realize L2 in language interaction in daily life. This study recommends future research into bilingual learning for different language branches, other languages..

### Acknowledgments

The research study was fully funded by the Faculty of Teacher Training and Education, Universitas Mahasaraswati Denpasar, Indonesia

### REFERENCES

Adnyani, N. P. S., Andriani Sari, R., Dambayana Suputra, P. E., Pastika, I. W., & Suparwa, I. N. (2018). Implementing ICT-Based Phonology Learning Material Using Blend space through Classroom Action Research. *Aksara*, 30(2), 319–330.

<https://doi.org/10.29255/aksara.v30i2.76>. 319-330

- Adnyani, N. P. S., & Pastika, I. W. (2016). Phonological Development in the Early Speech of an Indonesian-German Bilingual Child. *Research in Language*, 14(3), 329–350.
- Amengual, M., & Simonet, M. (2019). Language Dominance does not Always Predict Cross-Linguistic interactions in Bilingual Speech Production, *Linguistic Approaches to Bilingualism*, 10(6), 847 – 872. <https://doi.org/10.1075/lab.18042>.
- Boersma, P. (2001). Praat, a system for doing phonetics by computer. *Glott International* 5:9/10, 341-345.
- Buckingham, H. W., & Christman, S. S. (2008). Disorders of Phonetics and Phonology. In *Handbook of Neuroscience of Language* (pp. 127–135). Academic Press.
- Bungin, B. (2003). *Metodologi Penelitian Kualitatif*. Raja Grafindo Persada.
- Clark, J. M., & Paivio, A. (1991). Dual Coding Theory and Education. In *Educational Psychology Review* (pp. 149–210). Plenum Publishing Corporation.
- Dragger, K. (2010). Sociophonetic Variation in Speech Perception. *Language and Linguistics Compass*, 4(7), 473–480. <https://doi.org/10.1111/j.1749-818x.2010.00210.x>
- Flege, J. E., & Bohn, O.-S. (2021). The revised Speech Learning Model (SLM-r). *(ResearchGatePreprint)*. <https://doi.org/10.13140/RG.2.2.27529.06249>
- Galles, N. S., & Bosch, L. (2005). Phonology and Bilingualism. In J. F. Kroll & A. M. B. de Groot (Eds.), *Handbook of Bilingualism* (pp. 68–87). Oxford University Press.



- Harley, A. T. (2001). *The Psychology of Language From Data to Theory*. Psychology Press Ltd.
- Kegoe, M. (2002). Developing Vowel System as a Window to Bilingual Phonology. *The International Journal of Bilingualism*, 6(3), 315–334.
- Magloire, J., & Green, K. P. (1999). A cross-language comparison of speaking rate effects on the production of voice onset time in English and Spanish. *Phonetica*, 56(3-4), 158-185.
- Odden, D. (2005). *Introducing Phonology*. Cambridge University Press.
- Paivio, A. (1990). *Mental Representations: A dual coding approach*. Oxford Science Publication.
- Paivio, A. (1991). Dual coding theory: Retrospect and current status. *Canadian Journal of Psychology/Revue canadienne de psychologie*, 45(3), 255–287. <https://doi.org/10.1037/h0084295>
- Polinsky, M., & Scontras, G. (2019). Understanding Heritage Languages. *Bilingualism: Language and Cognition*, 23(1), 1–41. <https://doi.org/10.1017/S1366728919000245>
- Richards, J. C., & Rodgers, T. S. (2001). *Approaches and Methods in Language Teaching* (Second Edi). Cambridge University Press.
- Schane, S. A. (1973). *Generative Phonology*. Prentice-Hal, Inc.
- Schwartz, G. (2020). Asymmetric Across-Language Phonetic Interaction Phonological Implications. *Linguistic Approaches to Bilingualism*.
- Simonet, M. (2016). The Phonetics and Phonology of Bilingualism. In *Oxford Handbooks Online* (pp. 1–21). <https://doi.org/10.1093/oxfordhb/9780199935345.013.72>.
- Trevor A. Harley, T, A (2001). *The Psychology of Language from Data to Theory*. New York: Psychology Press Ltd
- Vihman, M. M. (2002). Getting started without a system: from phonetics to phonology in bilingual development. *International Journal of Bilingualism*, 239–254. <https://doi.org/https://doi.org/10.1177/13670069020060030201>
- Wardana, I. K. (2014). Kesalahan Artikulasi Phonemes Bahasa Inggris Mahasiswa Prodi Bahasa Inggris Unmas Denpasar; Sebuah Kajian Fonologi Generatif. *Jurnal Bakti Saraswati*, 3(2), 77–87.
- Yuniawan, T., Rokhman, F., Rustono, & Mardikantoro, H. B. (2018). Analysis of Types of Ecollexicon Expression in Conservation News Texts in Mass Media: Ecolinguistics Perspective. *4th PRASASTI International Conference on Recent Linguistics Research*, 334–343.