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What is the Best Way to Teach the Endangered Languages of Taiwan? A Call for Quantitative Research on Language Revitalization

Joshua K. Hartshorne (麻省總醫院健康職業學院 MGH Institute of Health Professions)

彭卉琪 Huei-Ci Peng (國立師範大學 National Taiwan Normal University)

Languages are rapidly disappearing. More specifically, the indigenous languages of Taiwan are disappearing. By definition, languages disappear because they are less and less reliably acquired by younger generations. In a sense, the solution is simple: teach the younger generations the languages.

In practice, the problem is more complex. The one method that we know reliably results in fluent speakers of a language is to raise them in homes that speak the target language and in communities where the language is widely-used and high-status. Unfortunately, this method is not available for under-resourced, endangered languages such as the indigenous languages of Taiwan.

Without that option available, communities trying to increase intergenerational transmission of their language turn to a variety of options, such as immersion schools (where the target language is the language of instruction), bilingual immersion schools (both the target language and a majority language are used for instruction), language nests (essentially pre-school immersion programs), college courses, and master-apprentice programs (where a younger individual is paired with a fluent elder) (Bommelyn & Tuttle, 2018; Gessner et al., 2018; Hinton, et al., 2018a; Hornberger & De Korne, 2018; O'Regan, 2018; Olawsky, 2013; Todal, 2018; Treuer, 2020; Wilson, 2018). Unfortunately, communities that adopt these

programs rarely reverse language disappearance, or even clearly slow it (Fishman, 1991; Goalabré, 2013; MacCaluim, 2007; McNaught, 2021; O'Grady, 2018; O'Regan, 2018; Todal, 2018). For instance, decades of immersion schooling for Gaelic and Breton have produced new speakers at a fraction of the rate older speakers are dying (Goalabré, 2013; MacCaluim, 2007).

Any number of explanations have been offered, including ineffectiveness of the programs, failure to adhere to the programs, lack of instructors, insufficient community interest, antithetical government policies, culturally or linguistically inappropriate pedagogical practices, and lack of opportunity to use the language outside the classroom (Hinton, et al., 2018b). Unfortunately for policy-makers and language activists, a list of factors that influence revitalization success is of limited usefulness unless accompanied by effect sizes. By analogy, regular exercise and better footwear will both improve marathon times, but one of these will have a much larger effect than the other. Many revitalization interventions are extremely expensive and time-consuming. For instance, a study of 33 master-apprentice pairs found that while the program requirements were onerous and difficult to meet, leading to high dropout rates, the mentors judged that apprentices did not learn enough to be effective speakers in the community (McIvor et al., 2023).

Where efficacy is studied, it is usually through small case-studies using qualitative methods such as interviews and observation (Hornberger & De Korne, 2018). This is insufficient (for additional discussion, see O'Grady, 2018; Obiero, 2010; Wiltshire et al., 2024; 周宣辰, 2016). Quantitative studies, where they exist, are often too small to assess statistical significance or measure effect sizes. For instance, one of the highest-quality studies of master-apprentice programs had only three subjects (Olawsky, 2013), and another had two (Sherkina-Lieber, 2021).

In the remainder of this note, we review what little is known quantitatively, with a particular focus on relevance to the case of Taiwan's indigenous languages. Our primary goal is to highlight the paucity of quantitative knowledge, in order to spur research that would better enable communities and decision-makers in Taiwan to reach their revitalization goals. We conclude with some specific suggestions.

First, however, we point out one area where Taiwan is substantially ahead

of the curve. One difficulty in evaluating language revitalization programs is that often there are no good assessments of language proficiency, making it difficult to establish just how much of the language has actually been learned (McIvor et al., 2023; O'Grady, 2018; Obiero, 2010; Olawsky, 2013; Wiltshire et al., 2024). Simply counting numbers of self-reported speakers of a language is unreliable: individuals vary substantially in what they count as "speaking a language", and their answers are often caught up in ethnic pride or private guilt. Taiwan has a robust system of standardized exams for all 42 recognized dialects. While these exams are not without criticism, they are much better than what is usually available (see O'Grady, 2018).

What Leads to (Un)successful Revitalization?

Teachers and Materials. A sufficient supply of well-trained teachers and appropriate materials would seem to be a prerequisite for successful education programs. In Taiwan, several language textbook series have been published, though these remain in a sense experimental (馬淑辛, 2023). Different kinds of languages need different kinds of instruction — for instance, it has been argued that polysynthetic languages require distinct pedagogy (Green et al., 2018) — and the education establishment's experience with teaching Taiwan's indigenous languages — and Austronesian languages more generally — is limited. These languages contain many features that are unusual in more commonly-taught languages, such as infixes, circumfixes, and the voice system. Similarly, in conversations, some experts we consulted worried that existing textbooks are often designed around English or Chinese textbooks, which are intended to get second-language learners speaking foreign languages in school rather than enabling heritage speakers to use their traditional language in their community, which involves (for instance) very different vocabulary.

Similarly, while preschool teachers in Taiwan are effectively required to have 2-4 years of training in early childhood education (Executive Yuan, 2022), this training is not tailored to the distinct needs of heritage language communities or immersion schooling (Björklund & Mård-Miettinen, 2014; Kisselev et al., 2020). There are now seven universities in Taiwan offering training in the teaching of indigenous languages. Anecdotally, however, many teachers still lack this training (see also 梁有章, 2018).

It remains to be seen just how much tailored textbooks and teacher

training ultimately matter. Children have learned languages since time immemorial without access to textbooks or teachers, simply by being spoken to. A more pressing matter may be an insufficient supply of teachers and media. In Taiwan, as in many countries experimenting with immersion education, there appears to be a shortage of qualified teachers who are fluent in the target language (Dwyer et al., 2018; Lin et al., 2022; Mumford, 2024; O'Grady, 2018; 周宣辰, 2016; 梁有章, 2018). Lack of fluent teachers is particularly acute for languages where most fluent speakers are elderly, which is increasingly the case for many languages in Taiwan. This can be addressed in part by teaching the language to the teachers: In Hawai'i, 99% of instructors in Hawaiian immersion schools in 2010-2011 were non-native speakers (NeSmith, 2012). However, because people who begin learning a new language after the age of 10 rarely reach native-like proficiency (Hartshorne et al., 2018), this means that children are likely learning from models whose command of the language is less than ideal. This is not necessarily a deal-breaker — children can learn a language well even if the speakers they are learning from have high speech error rates (Singleton & Newport, 2004) — but it likely impedes progress at least somewhat.

Similarly, while language textbooks are important for language courses, immersion schooling requires textbooks for other subjects (math, science, history, etc.) in the target language. Preschools need children's books, movies, music recordings and other content in the target language. These are all in short supply for Taiwanese indigenous languages, but it is unknown how much more is needed.

The effect of time spent in the language. In general, more time spent in a language will result in more learning, but the relationship is not straightforward. Bilingual-acquiring children spend half as much time in each language as a monolingual but learn almost as quickly (Hua & Hartshorne, in prep). How much is enough? O'Grady (2018) suggests that at least 25 to 30% of the total input to a child learner should be in the target language, or around 20 hours per week. This is far more than the 0.7 hours/week currently offered in Taiwanese primary schools, and substantially more than even time-intensive master-apprentice programs, which typically aim for around 5-10 hours per week (Hinton, et al., 2018a; McIvor et al., 2023; Olawsky, 2013). Perhaps not surprisingly, the limited quantitative work on master-apprentice programs suggest that apprentices do not become proficient speakers, even after several years

(McIvor et al., 2023; Olawsky, 2013; Sherkina-Lieber, 2021). Even a more ambitious, 2-year immersion program of Mohawk averaging 19 hrs/week left graduates "stuck" at intermediate levels of proficiency (Green et al., 2018).

In principle, bilingual schools could reach the 20 hour/week threshold with 4 hours/day in the target language. Schools often provide substantially less (Dwyer et al., 2018; Todal, 2018). For instance, bilingual indigenous schools in Mexico actually only do an hour a day of the indigenous language, which is not the language of instruction (Hornberger & De Korne, 2018). One factor may be policymakers overgeneralizing from English, where a few hours per week can be more effective because students encounter English frequently in daily life outside of school (Todal, 2018). Policymakers may also underestimate the difficulties, because whereas Taiwan's indigenous languages are unrelated to Mandarin, many well-studied and widely-discussed stable bilingual societies (Quebec in Canada, Catalonia in Spain, Switzerland) involve highly related languages, which provides a significant advantage to learners (Yun et al., 2023).

Immersion preschools in Taiwan are required to spend 50% of instructional time in the indigenous language, and thus are likely near the 20 hour/week threshold.[1] As already noted, primary schools provide less than 1 hour/week. This is clearly insufficient and needs to be increased. The question is, if 20 hours/week is impractical, just how much would be gained by each additional hour at the primary school level? It should be obvious from the review above that we are very far from being able to answer this question, but it is a critical one for educators and policymakers who are trying to balance different priorities.

A possible impediment to increased classroom time — particularly in primary and secondary school — is inflexible testing requirements. Taiwan's standardized exams are conducted in Chinese, so instruction in indigenous languages may be inconsistent with the goal of high scores. Similar issues have arisen elsewhere; for instance, national testing requirements implemented in the early 2000s in the United States made it difficult for schools to continue supporting native languages (Combs &

[1] In practice, it appears that not all immersion preschools come even close to this threshold (劉秋玲, 2018).

Nicholas, 2012; Wilson, 2012).

The role of extra-instructional time. O'Grady (2018) suggests minimum of 20 hours/week includes all input, not just instructional time. Indeed, it stands to reason that language education will be most effective when students have the opportunity to use the language outside the classroom. This is, after all, part of the motivation for study-abroad language programs (this belief is probably justified, though data remain scanty; Isabelli-García et al., 2018). Conversely, evidence suggests that children who do not have opportunities to use the language outside of school will not master it (Genesee, 1978; Goalabré, 2013; Hornberger & De Korne, 2018; Ward, 2003; Wilson, 2018; Zahir, 2018). Indeed, Zahir (2018) reports anecdotally that students learning Lushootseed, an endangered member of the Salish language family, reliably forgot the language faster than they learned it because they had no use for it outside the classroom. Zahir (2018, p. 157) writes, "My mistaken assumption was that if [students] learn the language well, they would use it. This in fact is not the case. Language learning does not lead to language use if there is no ... situation that necessitates speaking." Unfortunately, very often students in immersion programs for endangered languages do not have the opportunity to use the language outside the classroom. For instance, none of the households sending children to Breton immersion schools used Breton at home (Goalabré, 2013). Similarly, a study of children in Gaelic bilingual schools found that none used Gaelic with friends and hardly even with siblings, even those who otherwise spoke Gaelic at home (Goalabré, 2013). Since languages that children speak only with adults and not with their peers do not appear to be learned as successfully, this lack of usage among children is concerning.

The limited data we have for Taiwan show similar trends. 周宣辰 (2016) attributes limited success of indigenous immersion preschools in Taiwan in part to insufficient opportunity to use the language outside of school. A study of one immersion Paiwan preschool found that the children were spoken to in the target language outside of class only 20%-30% of the time by the parents, around 50% of the time by grandparents, and essentially never by siblings (Lin et al., 2022).

One possible reason that children in immersion programs for endangered languages do not always have much opportunity to use the languages outside the classroom may be because families with the least opportunities to use the endangered language in everyday life are sometimes the most

motivated to enroll their children in immersion programs. For instance, students are more likely to enroll in immersion Gaelic schools in areas where Gaelic is less widely spoken (Stockdale et al., 2003). Similar results have been reported for Breton (Goalabré, 2013). Indeed, children in immersion schools are not always even from the traditional community: in Australia, half the children in bilingual programs in 2008 were not themselves indigenous, and thus presumably have limited opportunities to use the languages outside school (Walsh, 2018) (though the opposite was reported for Saami (Todal, 2018)). Whether these issues apply in Taiwan is unclear.

For these reasons, some organizations have focused on providing family and community experiences in the target language, such as vacation activities, language summer camps for families, language trips and expeditions to hot-pools, skiing, beaches, star observatories, sporting events, cafe groups, and play groups (O'Regan, 2018). While these seem like excellent ideas and are often well-received, it is unknown just how many must be provided in order to be effective.

Limitations of scale. Of course, even if education is effective for individuals, it will not have much effect at the population level if few individuals receive the education. This has certainly been a limitation for Breton (the 14,082 pupils in Breton bilingual programs in 2011 accounted for only 1.5% of the school-age population) and Gaelic (only 2,316 students in enrolled in Gaelic schools in Scotland in 2011) (Goalabré, 2013). In Norway, only around 20 students are enrolled in South Saami immersion programs at any given time, out of an overall population of about 1,000 (Todal, 2018). Master-apprentice programs, where a learner spends 5-10 hours/week with a fluent speaker, are particularly difficult to scale up, and usually only involve a handful of speakers.

In Taiwan, a little over 1,000 children are in bilingual preschools (Fig. 1), compared to an overall indigenous population of about 580,000 (Government of the Republic of China (Taiwan), 2024). Another point of comparison is that while there are only 50-60 bilingual preschools, there are 2,166 elementary schools where at least 100 students are indigenous or 1/3 of the student population is (numbers compiled from government open data). From these numbers, it is clear that the bilingual preschools are only reaching a small fraction of the community.

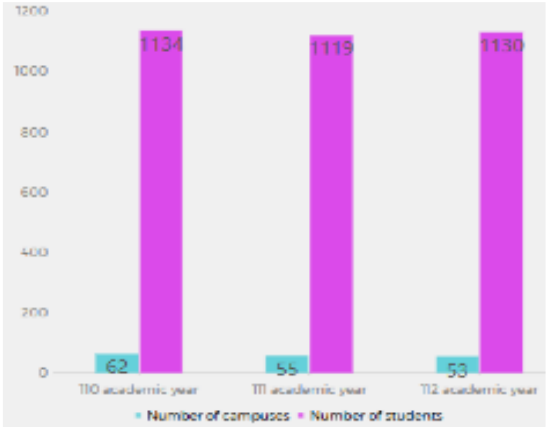

Fig. 1. Enrollment in indigenous language preschools in Taiwan has remained fairly steady in recent years. Data compiled from Ministry of Education (2024).

One question is how many schools are needed. Given the ongoing decline in Breton, Gaelic, and South Saami, enrolling only 1%-2% does little to move the needle. Is 100% enrollment required? Is there an inflection point, below which immersion programs are ineffective? Systematic comparison of immersion programs around the world, including those with high levels of enrollment such as Hawaiian, would be instructive.

Another question is what is driving the low enrollment rates: insufficient supply, insufficient demand, or something else. In the case of the South Saami, a critical factor is that the population is largely rural and spread over a wide geography, making it difficult to organize and deliver immersion education (Todal, 2018). In Taiwan, it appears that the large number of language communities causes similar problems, in that children must not just live near an immersion preschool but near a preschool providing immersion in their community's language. This is particularly challenging if families strongly prefer a school offering not just their language (1 of 16) but their dialect (1 of 42). For Breton, the issue of dialectal variation was addressed by only offering schooling in a standard dialect. However, this means that many students are learning a dialect that is not spoken in their community, making it difficult to put their classroom learning to use in the community (Goalabré, 2013). In such situations, parents may also be less enthusiastic about enrolling their children in schools that will teach them

something that the parents do not view as their language. This likely applies in Taiwan, where tribes have reportedly resisted standardization of the languages.

One potential solution is distance learning: providing language education via video conferencing. This would come at considerable cost, in that remote schooling is generally inferior to in-person, as the world learned during the Pandemic. The South Saami experimented with providing language lessons via video (other subjects remained in-person and in Norwegian), but the result has been unsatisfactory (Todal, 2018).

Other socio-cultural factors. A number of researchers have suggested that language revitalization requires a lot more than teaching people the language and giving them opportunities to speak it (Wiltshire et al., 2024). For example, one widely-discussed phenomenon is that of receptive bilinguals or "silent speakers" — individuals who can understand a language well but do not speak it (Gessner et al., 2018; Schlegel, 2004; Sherkina-Lieber et al., 2011). The First Peoples' Cultural Council in Canada has experimented with using Cognitive Behavioral Therapy, a clinical method that is effective for anxiety, to help silent speakers start speaking (Gessner et al., 2018).

Conclusions: A Call for Quantitative Research

The review above illustrates the problem facing educators, communities, and policymakers: there are far too many factors relevant to Taiwan's language revitalization goals to prioritize all of them, and in fact some are at cross purposes. For instance, what is the most effective tradeoff between increasing the supply of teachers and increasing training requirements (which typically decreases supply)? In choosing priorities, decision-makers have little more to go on than their own intuitions.

One thing is certain: The 40 minutes/week of indigenous language instruction in primary school is far too little. However, it is unclear exactly how much is needed, or whether any amount is sufficient without significant investments in language outside of school.

It would be helpful if the international experience with immersion schooling provided more quantitative insight. Fortunately, however, Taiwan is in an enviable position to conduct its own research: the large number of communities and the significant investment to date provides for

natural experiments. Below, we list several low-hanging fruit:

- Factors influencing enrollment rates. A basic question is whether low enrollment in immersion preschools is due to lack of demand or lack of supply? If it is a lack of demand, what factors influence demand? If a lack of supply, where should the government locate additional preschools? A great deal could be learned from existing demographic information. Is enrollment higher in areas with many speakers of the heritage language or fewer? How many families live within a reasonable radius of an immersion preschool offering their heritage language? Just as important would be surveying parents who have elected not to enroll their children in order to understand why.

- Factors influencing immersion success. Preschools are no doubt differentially effective in promoting the heritage language. As reviewed above, potential reasons include such factors as amount of time spent in the target language, the training and fluency of the teachers, and pedagogical methods. Detailing these factors and comparing to the fluency of the children would provide critical quantitative information useful for designing interventions. Care must be taken to factor out population differences, such as whether the children speak the heritage language at home. Note that such a study would require a standardized measure of fluency in the indigenous languages for 5-year-olds.

- Comparing immersion preschools with indigenous nannies. In addition to immersion preschools, Taiwan financially supports families who have their young children cared for in the home by indigenous language-speaking grandparents. An important question is which method is more effective for promoting fluency? Answering this question has implications beyond simply suggesting which program(s) should be prioritized: understanding differences in success may suggest ways of improving both systems.

- Measuring retention. The goal of the immersion preschools and indigenous nanny programs is not to have 5-year-olds speaking indigenous languages, but for those children to continue speaking the languages later. An important question, then, is whether the graduates maintain, lose, or improve their fluency once they enter

primary school. Of particular interest is whether this varies depending on whether the child receives the 40 minutes/week of instruction in their heritage language offered in primary school.

Note that research need not be exclusively correlational: ongoing investments in language revitalization allow for controlled experiments. Given the rapid decline in Taiwan's indigenous languages, however, such research will have far more value if conducted now as opposed to later.

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