# Attention Bias Modification
# for Anxiety in Second Language Acquisition

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## Abstract

According to recent research in clinical psychology, attention bias modification or cognitive bias modification can reduce the severity of anxiety in many people by liberating the brain from harmful cognitive biases. This study explores the possibility of using attention bias modification to reduce the severity of anxiety in students with foreign language anxiety. Six students of English as a second language at a school in Hawaii completed the Foreign Language Classroom Anxiety Scale, and afterwards, four of these students completed between twenty minutes and ninety minutes of attention bias modification training, while the remaining two students completed a similar amount of training with no attention modification. After the training, these six students retook the Foreign Language Classroom Anxiety Scale, and the scores from the two scales were compared. The results show that attention bias modification may be able to reduce anxiety in the second language classroom, and its potential as a treatment for foreign language anxieties should be tested further.

**Keywords**:  ABM, CBM, FLCAS, SLA, anxiety, bias, attention, foreign language

# Introduction

The significant influence of advanced technologies in second language learning is far from underappreciated by researchers. *Language Learning and Technology*, the Computer Assisted Language Instruction Consortium (CALICO), and many other important journals and organizations in the field of applied linguistics are devoted heavily or exclusively to exploring this influence, and a search on Google Scholar for the words *technology*, *language*, and *learning* returns 2,170,000 results. With so much attention and research devoted to the numerous roles that technology plays in foreign language learning, a truly novel use for technology in language education is a rare find, and yet, a recent discovery in clinical psychology may offer a new and interesting use for technology in second language study.

This new finding, cognitive bias modification, may help to reduce the severity of foreign language anxiety for some students, and thereby improve the academic performance of these students in the foreign language classroom while strengthening their willingness to communicate. Alternatively, foreign language anxiety may be resistant to the benefits of this new treatment. This study seeks to understand the efficacy and possible benefits or limitations of cognitive bias modification for foreign language anxiety.

**Literature Review**

Experimental psychologists have long proposed a causal relationship between anxiety disorders and attentional biases to threat: "Cognitive models assume that attentional bias is not simply a by-product of the emotional disorder but plays a vital role in its causation and maintenance" (Williams, Mathew, & MacLeod, 1996, p. 3). Indeed, numerous experiments have confirmed this relationship (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007). Anxious individuals have a hypersensitivity to threatening people and things, and this responsiveness affects their processing of information. Their anxiety affects memory and interpretation of information, but it also affects attention at the earliest, split-second encounter with something threatening. Anxiety can cause people to develop a threat-related bias that immediately, unconsciously, and habitually directs their attention to threatening objects in their environment.

MacLeod, Mathews, and Tata (1986) developed a well-known dot-probe task for measuring the threat-related bias that governs the attention of anxious individuals at the first sight of a threatening stimulus. In this task, participants sit in front of a computer and view two words or images that appear on different parts of the screen. These words or images are shown for only a split-second before disappearing, and at times, one of the words or images is immediately followed by a probe that appears in its place. The participants are instructed to click a button as soon as possible when they see this probe. MacLeod and his colleagues showed that anxious participants responded more quickly to the probe when it replaced a threatening word, while control subjects responded in the

opposite way: "Anxious subjects do indeed shift attention toward emotionally threatening stimuli in their visual environment. Normal control subjects, on the other hand, tend to shift attention away from such stimuli" (MacLeod et al., 1986, p. 18).

Beginning in 2002, researchers began to explore the possibility of using the dot-probe task as a tool for modifying attention rather than measuring it. This time, the participants viewed two words or images in different parts of a computer screen for half a second, one threatening and the other neutral, and a probe immediately appeared in the place where the threatening word or image had been. This probe was either one dot or two dots, and the participants had to discern this as quickly as possible, and press a button to indicate the number of dots. MacLeod, Rutherford, Campbell, Ebsworthy, and Holker (2002) developed this new version of the dot-probe task to induce an attentional orientation towards threatening information in the research subjects, and found that not only did their attentional bias change, but in a secondary test, they demonstrated a negative emotional reaction to a subsequent laboratory stressor, the completion of a stressful puzzle.

After seeing the results of this experiment, many experimental psychologists began to consider the possibility of using this dot-probe training as a treatment for anxiety disorders, addictions, phobias, depression, and any other conditions known to be affected by attentional bias . If attentional bias towards negative stimuli  can be induced in normal individuals, causing them to react anxiously to laboratory stressors, could the same techniques induce an attentional bias away from threatening stimuli, causing anxious individuals to react with less anxiety to previously stressful situations?

New treatments for anxiety and other cognitive ailments are greatly needed in clinical psychology, and they cause much enthusiasm, research, and skepticism: "In our field of research and practice few things generate more excitement than a new treatment for a major psychopathology such as the anxiety disorders, for which the considerable treatment data collected thus far leaves much room for improvement in treatment efficacy" (Bar-Haim, 2010, p.859). And if a new possible treatment for anxiety was not enough, the dot-probe training technique would be a completely new form of treatment, available at low cost to almost anyone who needs it. Modern technologies would allow people with anxiety disorders to complete the training without the need of doctors or medicine. They would only need to download an app and do the training while riding the bus to work or school.

With so much excitement for this new idea, numerous research projects in recent years have tested the potential of the dot-probe training paradigm for the treatment of various psychological ailments. Now called attention bias modification (ABM),  this training and other forms of cognitive bias modification (CBM) have been tested for the possible  treatment of generalized anxiety disorder (Amir, Beard, Burns, & Bomyea, 2009), social anxiety (Schmidt, Richey, Buckner, & Timpano, 2009), depression (Holmes, Lang, & Shah, 2009), arachnophobia (Reese, McNally, Najmi, & Amir, 2010), alcoholism (Wiers, Eberl, Rinck, Becker, & Lindenmeyer, 2011), and other conditions. And though CBM has also been tested as a potential treatment for the reduction of anxiety in students

who are studying abroad (See, MacLeod, & Bridle, 2009), it has not yet been tested for possible effects on foreign language anxiety.

A cheap and easy treatment for foreign language anxiety would be of great value to parents, schools, and ambitious students. As globalization continues to bolster the demand for strong foreign language skills, students are spending more time in foreign language classrooms and feeling even more pressure to achieve higher levels of proficiency. Meanwhile, research in second language acquisition shows that "substantial negative correlations in the order of $r = -0.45$ to $r = -0.65$ have been obtained across studies between [foreign language] anxiety scores and scores on direct measures of [second language] proficiency… a robust indication that high, debilitating levels of anxiety do interfere with academic achievement in foreign language classes" (Ortega, 2009, p. 201). Even a small reduction in the severity of foreign language anxiety may significantly help an individual student, and may considerably help a school or nation of language learners.

A treatment for foreign language anxiety, if successful, could possibly benefit students in several ways. According to MacIntyre and Gardner, and based on a model offered by Tobias (as cited in MacIntyre & Gardner, 1994, p. 286) foreign language anxiety affects learning at three stages: input, processing, and output (1994). And though a student's anxiety might not be evenly distributed across all three stages, it can interfere with the learning process during input, it can harm the processing of information after input, and it can cause problems when the student finally needs to produce what he or she has learned.

Several researchers have shown that cognitive psychological perspectives can explain the ways that foreign language anxiety interferes in language learning (MacIntyre & Gardner, 1994; Horwitz, 2001). For example, MacIntyre and Gardner have shown that "anxious students learned a list of vocabulary items at a slower rate than less anxious students and had more difficulty in the recall of previously learned vocabulary items" (1994, p.285). Foreign language learning requires multiple skills and cumulative learning, and anxiety is the wrench in the works that can hinder success for many students at multiple stages in the learning process.

And according to MacIntyre and Gardner, foreign language anxiety has much in common with other forms of anxiety: "While the instruments used to measure language anxiety should be specific to the language area, theoretical links to the more general anxiety literature can be strengthened" (1984, p. 255). Horwitz, Horwitz, and Cope agree: "The subjective feelings, psycho-physiological symptoms, and behavioral responses of the anxious foreign language learner are essentially the same as for any specific anxiety. They experience apprehension, worry, even dread. They have difficulty concentrating, become forgetful, sweat, and have palpitations" (1986, p. 126). If foreign language anxiety is similar to other anxieties, perhaps it is equally susceptible to CBM.

However, not all forms of anxiety have proven susceptible to CBM training. Reese, McNally, Najmi, and Amir have shown that CBM training cannot reduce the severity of anxiety in arachnophobia, even though the subjects in their study did produce an attentional bias away from the threatening stimuli (2010). Reese and her colleagues

theorize that the anxiety of arachnophobia is different from the anxieties in other disorders that have shown successful anxiety reductions in response to CBM training. They say that arachnophobia is a stimulus-driven anxiety, whereas other anxieties are ruminative. A person with arachnophobia feels no anxiety until the stimulus, a spider, is present and in view (2010). Similarly, a person with foreign language anxiety might not feel anxiety until required to speak in the target language, or interact with a foreign person.

As suggested by a recent article in *The Economist*, a stimulus-driven anxiety like arachnophobia may be the result of evolutionary forces at work, and thus, a fear that is not amenable to CBM (2012). Is foreign language anxiety not a similar, deeply rooted anxiety and fear? The language faculty of humans is not a recent development in human evolution and is deeply woven into the fabric of the human mind. When people are unable to speak or communicate well, they are unable to be themselves: "any performance in the L2 is likely to challenge an individual's self-concept as a competent communicator and lead to reticence, self-consciousness, fear, or even panic" (Horwitz, Horwitz, & Cope, 1986, p. 128).

This study seeks to answer the following questions: As measured by Horwitz, Horwitz, and Cope's Foreign Language Classroom Anxiety Scale (1986), can attention bias modification training reduce the severity of reported symptoms of anxiety in students of English as a second language? If so, is foreign language anxiety a stimulus-driven anxiety or a ruminative anxiety?

## Materials and Methods

**Participants**

A request for volunteers was posted at a school for English as a second language in Hawaii. Twelve students responded to this request and offered to volunteer. Among these twelve, six were chosen for an attention bias modification (ABM) group, and the remaining six were chosen for a control group. A PDF version of the Foreign Language Classroom Anxiety Scale (Appendix C) was sent to all volunteers, but only nine participants completed the form and returned it to the author. Among these nine, five were members of the ABM group, and four were members of the control group. The participants' ages ranged from 19 years old to 25 years old, and all were intermediate or high-intermediate level speakers, listeners, readers, and writers of English, as measured by the language school's assessment methods. Two of the participants were Korean nationals, and the other participants were Japanese nationals. Seven participants were women, and one was a man.

The members of the ABM group were sent an ABM training application by email, and the control group members were sent a neutral training application. Both groups were instructed to complete, if possible, two or more training sessions each day for three days, but by the end of this time period, only seven volunteers had completed any training, and one of these had completed only one session of training. The data of only those participants who completed two or more training sessions was analyzed. Only four

members of the ABM group completed enough training for analysis, and two members of

the control group. These six volunteers were sent another PDF copy of the FLCAS, and

were asked to mark their answers based on their experiences inside and outside of class

during the three days when they were doing the training sessions. These six forms were

returned to the author by email, and these are the six participants whose results were used

for analysis.

**Instruments**

Three instruments were used in the experiment: a PDF version of Horwitz,

Horwitz, and Cope's Foreign Language Classroom Anxiety Scale (FLCAS) (1986), and

two interactive training applications that were created for the study by the author. The

PDF version of the FLCAS was an unaltered version of the original, and the interactive

ABM training applications were based on a popular dot-probe task (Bar-Haim, 2010), first

developed by MacLeod and colleagues in 1986.

The author created a PDF version of the FLCAS and distributed it to the

participants by email. These forms were completed anonymously and responses were

automatically sorted by Adobe's Acrobat Pro software. For each question on the survey,

the participants' answers were given a score of -2, -1, 0, +1, or +2.  A -2 score was given

for answers that reflected a strong anxiety, a -1 score was given for answers that reflected

anxiety, a 0 score was given for neutral responses, a +1 score was given for answers that

reflected a positive attitude, and a +2 score was given for answers that reflected the

strongest positive attitude. For each FLCAS response form, the scores for all 33 questions were added together, and the final number was used to assess the level of anxiety felt by the participant who filled the form. For example, a -15 score means that the person experiences a large amount of anxiety in the foreign language classroom, while a +25 score means that the person experiences very little anxiety in the foreign language classroom. (see appendix C)

Two interactive training applications were created by the author in order to allow the participants to complete the ABM training at any time of day, using their personal laptop computers or iPad tablet computers. The training applications were sent to the participants by email, and the participants used Quicktime software to open the applications and do the training.  The ABM group used a training application designed to induce an attentional bias away from threatening faces, while the control group used a neutral training application designed to induce no attentional bias. (See Appendix A and B) The training application for the ABM group required participants to stare at a focal point until two images of faces appeared for only 0.5 seconds, a  face with an emotionally negative expression and a face with an emotionally positive expression. Immediately after these images disappeared, a small circle or triangle appeared in the space where the emotionally positive face had been, and the participant was instructed to click on the matching shape at the bottom of the screen, as quickly as possible. The training application for the control group was similar, but directed the attention of participants

from neutral images to neutral images. From start to finish, a typical training session required between 6 and 10 minutes of the participants time.

**Procedure**

After completing the first FLCAS, a copy of the ABM training application was sent to each of the participants in the ABM training group, and a copy of the neutral training application was sent to the control group participants. All participants were given the following instructions for their attention training applications: "Click or press the start button on the first slide. After this, you will see a grey circle. Please focus your attention on this grey circle while waiting for one or two seconds. You will suddenly see two images for only 0.5 seconds, and immediately after they disappear, you will see a circle or triangle in the space where one of the images had been. If you see a circle, please press the circle button at the bottom of screen as soon as possible. If you see a triangle, quickly press the triangle button at the bottom of the screen. Repeat these steps until you see a message telling you to stop. Complete the training as quickly as possible." (see appendix A and appendix B) After 3 days of training, the participants completed a second FLCAS, answering the questions based on their experiences during the 3 days of training sessions.

## Results and Discussion

With only four participants completing the necessary training in attention bias modification, and with only two control subjects completing their training, the results do not provide enough data to prove or disprove an efficacy of attention bias modification for the reduction of foreign language anxiety, nor do they provide enough evidence to show if foreign language anxiety is stimulus-driven or ruminative. However, the resulting data offer enough information to suggest that a larger and longer experiment is worth the effort. The results reveal a significant reduction in anxiety for almost all of the students of English as a second language who participated in the study.

Three of the four participants in the ABM group experienced a reduction in reported anxiety during the 3 days of ABM training, and the participant (Sophia) who began the training with the highest levels of anxiety saw the most improvement. Meanwhile, the two subjects (Isabella & Emma) who began the training with the least amount of foreign language anxiety, reported even less anxiety after 3 days of ABM training. Perhaps, their already low levels of anxiety prevented a greater reduction during the training period. Only one participant experienced an increase in reported anxiety, though only a small amount (Jacob). Interestingly, the only male participant in the study was also the only participant to see an increase in feelings of anxiety.

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Surprisingly, the two participants in the control group also experienced a
significant decrease in reported anxiety during the 3 days of training, though their training
was not designed to produce an attentional bias modification. However, this is not the first

## Attention Bias Modification Group

Sessions Completed

| | Before Training Sessions | After Training Sessions |

| Sessions Completed | | |
| --- | --- | --- |
| 6 | Sophia | |
| 3 | Jacob | |
| 4 | Isabella | |
| 6 | Emma | |

-20   -10   **0**   10   20   30   40

← More Anxiety   Less Anxiety →

## Control Group

Sessions Completed

| | Before Training Sessions | After Training Sessions |

| Sessions Completed | | |
| --- | --- | --- |
| 2 | Olivia | |
| 4 | Ava | |

-15   -8   **0**   8   15   23   30

← More Anxiety   Less Anxiety →

time that a research project has produced a placebo group with a large reduction in anxiety that equals the results of the project's ABM group (Carey, 2012).

Attention bias modification shows promise as a means for helping to reduce anxiety in the foreign language classrooms, and a larger and more extensive research project is needed in order to explore in detail the possible uses of attention bias modification for foreign language anxiety. Before this, however, researchers should first test for unique attention biases that might be present in individuals with foreign language anxiety. Do students with foreign language anxiety have any attentional biases that are similar to those found in people who suffer with similar anxiety problems? Do they have any attentional biases that are unique to foreign language anxiety?

Further research should also explore the possibility of approach biases in foreign language anxiety, and investigate the possibility of approach biases in students who demonstrate an insufficient willingness to communicate. If an approach bias similar to the kind discovered by Wiers and colleagues (2011) is found in students with foreign language anxiety, an approach bias modification program can be tested for efficacy in helping to increase a foreign language student's willingness to communicate, especially in contexts where students are studying a second language in a country where the language is spoken.

This study has shown that for some students, attention bias modification may be able to reduce the feelings of anxiety that they feel in the foreign language classroom. Future research will be needed to confirm this, and future research will be needed to see if

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this reduction in anxiety can result in language proficiency improvements, and better

grades.

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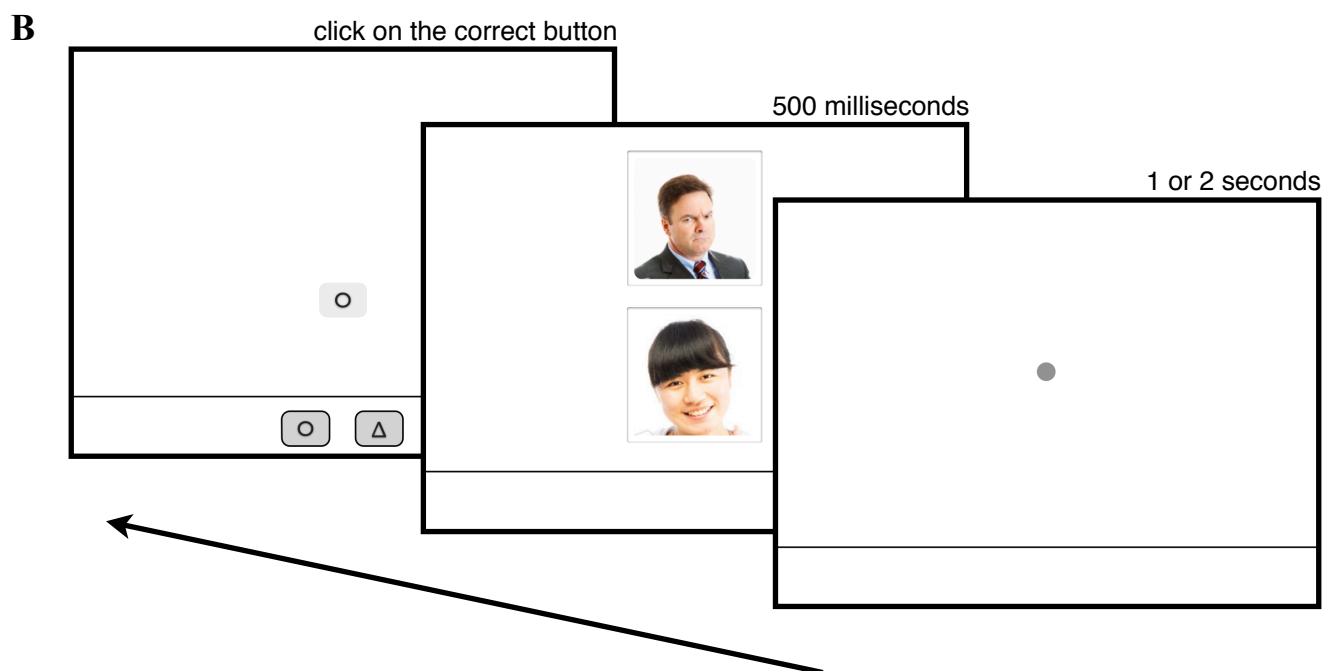
# Appendix

**A**    An example of the author's interactive application for
attention bias modification training can be downloaded from this dropbox link:
https://dl.dropbox.com/u/25309974/CBM%20for%20SLA%20%21.key
You will need the latest version of Apple's Quicktime to use this application:
http://www.apple.com/quicktime/download/

**B**

C

**Foreign Language Classroom Anxiety Scale**
Horwitz, E. K., Horwitz, M. B., & Cope, J. (1986). Foreign language classroom anxiety. *The* Modern Language Journal, 70(2), 125-132.

When were you born? ( Month / Day / Year )  ( _____ / _____ / _____ )

1

**1. I never feel quite sure of myself when I am speaking in my foreign language class.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**2. I don't worry about making mistakes in language class.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**3. I tremble when I know that I'm going to be called on in language class.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**4. It frightens me when I don't understand what the teacher is saying in the foreign language.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**5. It wouldn't bother me at all to take more foreign language classes.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**6. During language class, I find myself thinking about things that have nothing to do with the course.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

Foreign

Language

Classroom

Anxiety

Scale

2

**7. I keep thinking that the other students are better at languages than I am.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**8. I am usually at ease during tests in my language class.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**9. I start to panic when I have to speak without preparation in language class.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**10. I worry about the consequences of failing my foreign language class.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**11. I don't understand why some people get so upset over foreign language classes.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**12. In language class, I can get so nervous I forget things I know.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**13. It embarrasses me to volunteer answers in my language class.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

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**14. I would not be nervous speaking the foreign language with native speakers.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

3

**15. I get upset when I don't understand what the teacher is correcting.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**16. Even if I am well prepared for language class, I feel anxious about it.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**17. I often feel like not going to my language class.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**18. I feel confident when I speak in foreign language class.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**19. I am afraid that my language teacher is ready to correct every mistake I make.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**20. I can feel my heart pounding when I'm going to be called on in language class.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

Foreign

Language

Classroom

Anxiety

Scale

**21. The more I study for a language test, the more con- fused I get.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**22. I don't feel pressure to prepare very well for language class.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

4

**23. I always feel that the other students speak the foreign language better than I do.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**24. I feel very self-conscious about speaking the foreign language in front of other students.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**25. Language class moves so quickly I worry about getting left behind.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**26. I feel more tense and nervous in my language class than in my other classes.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**27. I get nervous and confused when I am speaking in my language class.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**28. When I'm on my way to language class, I feel very sure and relaxed.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**29. I get nervous when I don't understand every word the language teacher says.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**30. I feel overwhelmed by the number of rules you have to learn to speak a foreign language.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

5

**31. I am afraid that the other students will laugh at me when I speak the foreign language.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**32. I would probably feel comfortable around native speakers of the foreign language.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

**33. I get nervous when the language teacher asks questions which I haven't prepared for in advance.**
☐ Strongly agree
☐ Agree
☐ Neither agree nor disagree
☐ Disagree
☐ Strongly disagree

Foreign

Language

Classroom

Anxiety

Scale