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**PREDICTIVE POWER OF ENGLISH TESTING: TRAINING INTERNATIONAL FLIGHT STUDENTS**

Mark Dusenbury and Elizabeth Bjerke

**Abstract**

Due to the impending pilot shortage in Asian countries many prospective students are being sent to the United States to receive their initial flight training. The purpose of this study was to determine if Chinese students entering an American flight program with higher English testing scores are more successful in completing their private pilot certification. A sample size of 141 Chinese students was used for this study. T-test analyses was conducted to determine if students who had higher English scores were more successful in completing private pilot training. Significant relationships were found between oral scores, Versant scores and private pilot completion. Multiple regression was used to determine if a relationship existed between a student's English score and his or her academic and flight performance. Significant relationships were found between the student's English screening scores, academic grades, and flight performance.

It is estimated that over 466,000 pilots will be needed in the next 20 years in order to meet the worldwide demand (Boeing, 2011). Part of the need is derived from an aging workforce that will bring on massive retirements in the coming years. The other factor is from an increase in global flying demands that is estimating 30,000 new aircraft over the next 20 years (Boeing, 2011).

The largest demand for pilots comes from China where they are projected to need 70,600 pilots over the next 20 years (Boeing, 2011). The restricted airspace and the lack of flight training facilities in China make it necessary for airlines in China to send the students to international flight schools to meet the increasing pilot demand. The United States has taken a large role in training international pilots.

According to the Federal Aviation Administration (FAA), there has been a 62% increase in active pilots with permanent foreign addresses in the last five years (FAA, 2011). Active commercial pilots accounted for the largest increase from 7,114 in 2005 to 15,418 in 2009 (117%). This activity clearly shows that there has been a large increase in international pilots training in the United States; this is in large part due to the demand for pilots in the Asian market.

With the increase in training comes a unique set of challenges. One of the specific challenges for flight training schools is making sure English proficiency is at an acceptable level before a student begins flight training in the United States. English-based aviation training presents unique challenges to international students because of the technical vocabulary utilized; and, in the specific case of pilots, they have to speak on a radio where they lose part of their communication cues (i.e., body language and other non-verbal communication capabilities). Learning to speak fluent aviation language starts with having a fundamental grasp on English and then applying it to a technically dense aviation vocabulary.

**Literature Review**

The perceived role of culture plays a major part in how teenagers transition to adulthood. This lens gives a view of what society expects from their young emerging adults (Badger, Nelson, & McNamara, 2006; Feng, 1991). Badger, Nelson, and McNamara (2006) found the Chinese culture to be more collectivistic and American culture more...
individualistic. The Chinese culture centers on family and finding ways to help them. This external pressure, and how it is viewed by society, puts more pressure on the Chinese teenager to transition to adulthood more rapidly than that of a western society (Badger et al., 2006).

The Chinese viewpoint and expectation on their young emerging adults comes from a strong Confucian belief structure (Badger et al., 2006; Huang & Brown, 2009). Confucian beliefs in China ripple through the social and educational systems. Children raised in China are taught to respect their parents, elders, and teachers. There is also considerably more respect for authorities, especially for individuals and families with lower social status. The most important aspect of raising children in China is ensuring they are cultured and educated in a way that ensures loyalty to the state (Badger et al., 2006).

One effect of Confucian-influenced Chinese educational and societal principles is that its students (i.e., mainly college) have a difficult time with the transition to the United States cultural and educational system (Feng, 1991). Feng (1991) and Zhai (2002) identified three areas of concern: 1) cultural differences and social interaction, 2) academic concerns, and 3) language ability. Academic and social stressors, along with cultural and language stressors need to be broken down individually and then synthesized. Each presents its own unique challenges as well as the interactions of that each have on the whole. The literature review will examine academic difference and stressors, cultural differences, and language skills that Zhai (2002) and Feng (1991) identified.

Cultural Differences

Chapdelaine and Alexitch (2004) define culture shock as having difficulty in cultural interactions. Young adults who leave home for the first time to enter the military or to go to college in their native countries experience a form of culture shock. Being unaware of certain cultural rules presents unique challenges to foreign students in higher education while studying abroad (Chapdelaine & Alexitch, 2004). Feng (2009) found students from China transitioning to the United States had difficulty with many of the Western cultural and social interactions; these include beliefs in God, feelings of isolation and homesickness during the American and Chinese holidays, and jokes in the classroom by native students and professors.

Chapdelaine and Alexitch (2004) found that students were unprepared for the cultural transition because they did not know the cultural rules. This lack of knowledge presents many different social challenges for international students. Behaviors that are typically reinforced in positive ways in their home country do not elicit the same type of response (Chapdelaine & Alexitch, 2004). It is very difficult for Chinese students to understand and feel comfortable with American students’ individualism and freedom of expression. American principles are at odds with the Chinese principle of self-control (Badger et al., 2006; Feng, 1991). Chinese students may retreat from the larger American culture, a noted phenomenon wherein international students are known to isolate and to create their own social and support communities (Feng, 1991, McLachlan & Justice, 2009).

Cultural isolation and cultural integration are differing approaches foreign students take in adapting to their host country. The approach of making friends from their home country grounds the students in their familiar culture for many international students (Misra, Crist & Burant, 2003). These students are likely to seek out and make friends with students from their home countries, which are helpful in some ways; however, it will hurt in other ways. Misra, Crist, and Burant (2003) note that isolation makes it difficult to commit to learning the new culture in their host country, although isolation does offer students a welcome relief from language and social anxiety (McLachlan & Justice, 2009).

Those international students that seek integration, find one barrier to their transition is the difficulty in finding the balance between their home culture and the new host culture (Lin & Yi, 1997). Yeh and Inose (2003) found that students who had a higher level of connection had an easier transition, and often the transition depended on the student’s background (Andrade, 2006). Students who can find and grow a strong social network are more successful integrating into the host culture.

Academic Concerns

The academic concerns that international students face impact all of their activities inside and outside of the classroom. It is imperative that programs do not marginalize the academic concerns and challenges facing international students. In China most high school students are unable to pass college entrance exams (Feng, 1991). Thus, those that do succeed face tremendous pressure to perform (Feng, 1991, McLachlan & Justice, 2009). Bifuh-Ambe (2009) found that international students lacked appropriate skills for listening to lectures, taking notes, and reading textbooks. Wang & Makkuinckrodt (2006) found that Chinese students are more likely to experience academic stress because the educational system in China varies greatly from the United States system. Students who
adapted socially or educationally to western culture norms, even to a small degree, had a much easier academic transition (Wang & Makkinckrodt, 2006).

Language Ability

The ability to transition from formal English to conversational English is one of the biggest concerns for foreign students transitioning into a university in the United States (Feng, 1991). Bifuh-Ambe (2009) found the best way to build language fluency (conversational English) is by socializing with the host culture. This is the best way, but also one of the most difficult things for international students to accomplish during the initial transition to the United States. Students with anxiety about their language skills tend to withdraw and fall into monoethmicism (McLachlan & Justice, 2009). Finding ways to reduce international students’ language anxiety is a key to unlocking their language abilities. High level language ability provides the student with the required communication skills to excel academically and socially. Difficulty with language comprehension is the largest issue when transitioning to a new culture (Zhai, 2002; Yeh & Inuse, 2003).

Commonly used college language entrance exams are largely written in and test passive English skills. Thus students are meeting the minimum entrance requirements, but are largely unprepared for listening and taking notes during lectures at a college level (Bifuh-Ambe, 2009). Zhai (2002) found that international students felt studying was hard in the United States because of the way courses are taught and expectations inside and outside the classroom are very different from their culture. Zhai (2002) also found that students did not anticipate and prepare for the academic transition; therefore some type of academic orientation should be provided to the students by the host institution.

Student Screening & Testing

International student aviation training presents unique English language related issues that each flight training institution needs to identify, study, and address. In a high stakes environment, where failing an English test costs the student the opportunity to study and become a pilot, schools need to understand which testing will provide practical, reliable, and valid results.

Collegiate aviation programs are required to work within the bounds of their respective admission policies. For international students this includes taking an English test like the TOEIC, TOEFL, or the IELTS. Students are required to meet a minimum score in order to gain entrance into the college or university. Portions of the international flight students training in the United States are what would be called “contract students.” The company they work for is paying for them to get their flight ratings and take a limited number of other classes. These students then return to their home countries and fly for the sponsoring airline. The FAA requires that a pilot demonstrate the ability to read, write, and understand the English language. AC 60-28 provides limited guidance on how an examiner or flight instructor should evaluate the student’s English skills, it provides no guidance on how a Part 141 Flight School should initially screen applicants prior to starting flight training.

The International Civil Aviation Organization (ICAO) has recognized the deficiencies in using commercially available English tests, such as the TOEFL when testing for aviation English proficiency. The following excerpt is taken from the ICAO website: (http://www.icao.org):

Most of the commercially available English knowledge tests such as TOEFL are not appropriate for the purpose of testing English competency for pilots and air traffic controllers. The main reason is that those tests have not been designed for testing the “speaking and listening ability” required by Annex 1. Some oral proficiency tests are available but they are generally designed for a context (e.g., business) that is not that of civil aviation and are therefore not fully satisfactory.

Generally speaking, the evaluation of the speaking and/or listening skills requires face-to-face contact between tester and test-taker, or semi-direct contact, through recorded speaking prompts and recorded responses that are analyzed later by the tester. Other testing methods and in particular those using only “pen and paper” tests or their computerized versions are not appropriate (ICAO, 2012, Para 68).

For international aviation students that are not seeking a degree, taking a pre-screening test that focuses on speaking and listening is more applicable. However, there is the issue of the students’ background. Can a student, who has a limited aviation background take the ICAO Aviation English Test as a pre-screening tool? To address this issue the researchers conducted an internal study. The study compared students who took the Versant Aviation English Test (VAET), Versant English Test (VET), and a face-to-face oral test with a trained professional.
English Testing

The VAET is an aviation English test that determines what level the student is on the ICAO scale. The VET is a general speaking and listening test used by large multinational corporations to screen for English during the hiring process. The oral test was designed in-house by speech pathologist and English as a Second Language experts and tested basic conversational skill, articulation, and clarity.

Early use of the VAET in screening, indicated that students who have a limited aviation background struggled. There were some students who scored high on the VAET, but post testing interviews revealed a more extensive background in aviation than their lower scoring counterparts. Based on this testing and ICAO’s recommendation the VET and oral interview were used for initial screening. This research applies to non-degree seeking international contract flight students. International students who are degree seeking should be required to follow prescribed university and college entrance requirements.

This study examined academic and flight performance in relation to English scores and answers the following research questions:
1) Are Chinese students entering a large collegiate flight program with higher English scores more successful in completing their private pilot certification?
2) Do Chinese students entering a large collegiate flight program with higher English scores perform better academically?
3) Do Chinese students entering a large collegiate flight program with higher English score perform better in flight courses?

Methodology

Setting

Data for this study was acquired at two separate locations. The English scores (Oral and VET) were obtained during routine pre-screening in China by trained professionals. The flight training was completed at a large public, four-year, research university in the upper mid-west region of the United States. The private pilot training course utilized for this study is FAA Part 141 approved with examining authority. It should be noted that although these Chinese students are enrolled at the University, their flight training and academic course work is done at an accelerated pace, thus they are enrolled in their own separated classes. The typical training sequence is about twice as fast as the traditional undergraduate flight training.

Participants

Participants in this study were Chinese flight students who were selected to come to the United States for flight training. The selection process started by the students taking the International English Language Testing System (IELTS) test in China prior to being screened by the university. If the student meets a minimum score on the IELTS, they are scheduled for an oral exam and a computerized test. The oral exam is administered by trained university staff and faculty in conjunction with a speech and language pathologist consultant. The computer test used is the Versant English Test (VET), which is used by large multinational corporate call centers to screen the English proficiency of potential employees. Validity tests on the VET were done comparing computer generated results with human transcription and independent human testing. Correlation between the two was found to be 0.97 (Pearson, 2008). Research also found a .75 to .94 correlation with other similar English speaking testing instrument (Pearson, 2008).

Data Collection

Data used in this study came from two main sources. The first source contained the pre-screening English testing scores that were calculated in China, prior to the students’ arrival in the United States. The flight training and academic records were collected from an internal database used by the college to track and store information needed to comply with Federal Aviation Regulations Part 141. The study used quantitative research methods to determine if higher English scores lead to more students completing private pilot certification, receiving higher academic grades, and lower flight hours.

Procedures

Initial data collection were completed utilizing Microsoft Excel 2007 Data were then transferred into Statistical Package for Social Science (SPSS) version 18.0. The first step in analysis was to calculate descriptive statistics such as means, standard deviations, ranges, and frequencies in order to better understand the complete dataset. The second step in the analysis was to run a series of statistical tests, based on the input variables to answer the three research questions. A .05 level of significance (alpha-level) was used for this study.

Results

The target population for this study consisted of Chinese flight students who conducted their training in a collegiate Part 141 aviation program. The total sample size consisted of 141 individuals who completed the pre-screening English testing and were selected to come to the United States to complete flight training. The descriptive
statistics of the two pre-screening English tests are presented in Table 1. The Oral score (N=139) had a range of four to seven with a mean of 6.72 and a standard deviation of 1.22. The VET score (N=141) had a range of 25 to 66 with a mean of 39.94 and a standard deviation of 6.44.

Table 1
Descriptive Statistics on Oral and VET Score

<table>
<thead>
<tr>
<th></th>
<th>Oral Score</th>
<th>VET Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>6.72</td>
<td>39.94</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>1.22</td>
<td>6.44</td>
</tr>
<tr>
<td>Range</td>
<td>7</td>
<td>41</td>
</tr>
<tr>
<td>Minimum</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>Maximum</td>
<td>10</td>
<td>66</td>
</tr>
<tr>
<td>Count</td>
<td>139</td>
<td>141</td>
</tr>
</tbody>
</table>

The dependent variables used to answer the research questions consisted of both academic and flight time performance documented during the private pilot curriculum. Table 2 presents the descriptive statistics of each of the dependent variables used in the research.

Table 2
Descriptive Statistics on Dependent Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Grade</td>
<td>141</td>
<td>87.62</td>
<td>4.99</td>
</tr>
<tr>
<td>Block 1 Flight Hours</td>
<td>137</td>
<td>34.91</td>
<td>6.38</td>
</tr>
</tbody>
</table>

Of the sample, 11% (N=16) did not successfully complete their private pilot training. In order to answer the first research question (Do Chinese students entering a large collegiate flight program with higher English scores successfully complete their private pilot certification?) two independent sample t-Tests were performed. The first two-sample t-Test analyzed whether there was any difference in the Oral scores between students who successfully completed the private pilot training and those who were not successful. Table 4 presents the results of the Oral exam score. This variable was found to be highly significant (p < .001), meaning that the students who successfully completed the private pilot training had significantly higher oral scores than those who were not significant.
Table 4
\(t\)-Test analysis comparing completions and Oral score.

<table>
<thead>
<tr>
<th></th>
<th>Complete Training (Yes)</th>
<th>Complete Training (No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>6.85</td>
<td>5.72</td>
</tr>
<tr>
<td>Variance</td>
<td>1.42</td>
<td>.86</td>
</tr>
<tr>
<td>Observations</td>
<td>125</td>
<td>16</td>
</tr>
<tr>
<td>(df)</td>
<td>137</td>
<td></td>
</tr>
<tr>
<td>(t) Stat</td>
<td>-3.64**</td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

\(**p < .01.\)

A second two-sample \(t\)-Test analyzed whether there was any difference in the VET scores between students who successfully completed the private pilot training and those who were not successful. This variable was also found to be significant (\(p=.016\)), indicating again that students successfully completing the private pilot training had significantly higher VET scores, than those not successful in completing the private pilot training. The results of the second \(t\)-Test are depicted in Table 5.

Table 5
\(t\)-Test analysis comparing completions and VET score

<table>
<thead>
<tr>
<th></th>
<th>Complete Training (Yes)</th>
<th>Complete Training (No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>40.40</td>
<td>36.31</td>
</tr>
<tr>
<td>Variance</td>
<td>41.73</td>
<td>26.21</td>
</tr>
<tr>
<td>Observations</td>
<td>125</td>
<td>16</td>
</tr>
<tr>
<td>(df)</td>
<td>139</td>
<td></td>
</tr>
<tr>
<td>(t) Stat</td>
<td>2.43*</td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.016</td>
<td></td>
</tr>
</tbody>
</table>

\(*p < .05.\)

In order to answer the second research question (Do Chinese students entering a large collegiate flight program with higher English scores perform better academically?) a multiple regression analysis was utilized as the primary statistical test. The full model analysis determined that there was a significant relationship between English scores and the student’s academic performance during their private pilot training. As seen in Table 6, the English screening scores accounted for 11.7% (\(R=.342, R^2=.117, F=9.01, df=2, 136, p<.01\)) of the variance in the academic grade. The Oral score had the most significant relationship with the academic grade.
Table 6  
*Beta* Weights, *t* Values, Significance of *t*, Correlation Coefficients and Significance of the Academic Grade in relation to English testing scores.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Beta</th>
<th><em>t</em></th>
<th>Sig. of <em>t</em></th>
<th>Corr.</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral Score</td>
<td>1.349</td>
<td>3.738</td>
<td>&lt;.001</td>
<td>.341</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>VET Score</td>
<td>.026</td>
<td>.389</td>
<td>.698</td>
<td>.162</td>
<td>.028*</td>
</tr>
<tr>
<td>Full Model R²= .117</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**p < .01, *p < .05.

To answer the final research question (Do Chinese students entering a large collegiate flight program with higher English score perform better in flight courses?) multiple regression analysis was again utilized as the primary statistical test. In order to quantify flight course success, the scale variable of flight hours was used. Flight time analyzed consisted of the amount of hours obtained in the first block of training. This training can be traditionally thought of as ‘pre-solo’ flight training. The full model analysis determined that there was a significant relationship between English scores and the student’s flight time in the first block of training. As seen in Table 7, the English screening scores accounted for 10.0% (R=.317, R²=.100, F=7.35, df=2, 134, p<.001) of the variance in the flight training time in Block 1. The Oral score had the only significant relationship with the Block 1 flight time.

Table 7  
*Beta* Weights, *t* Values, Significance of *t*, Correlation Coefficients and Significance of the Block 1 Time in relation to English testing scores.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Beta</th>
<th><em>t</em></th>
<th>Sig. of <em>t</em></th>
<th>Corr.</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral Score</td>
<td>-316</td>
<td>-3.525</td>
<td>.001</td>
<td>-.317</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>VET Score</td>
<td>-002</td>
<td>-.026</td>
<td>.979</td>
<td>-.125</td>
<td>.075</td>
</tr>
<tr>
<td>Full Model R²= .10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**p < .01.

**Recommendations and Conclusions**

The results have multiple implications for university administrators and professional flight managers engaged in international flight training, specifically with China. The first is that a solid English screening plan should be implemented and in place prior to accepting students for flight training. Higher English scores increase the likelihood the student will persist and complete private pilot training with a lower number of hours. The oral score was found to be highly predictive of private pilot completion.

University and aviation professionals can have successful English screening programs by working closely with consultants and field experts. ICAO also states most English tests don’t evaluate “...speaking and listening ability...”, but there are tests available commercially that are
**English Testing**

designed to test speaking and listening that are general in nature. These types of speaking and listening tests are used by multinational corporations like Dell and Microsoft to test applicants for computer support call centers. The student's background should be examined to determine if a generic English speaking test like the VET is to be used, or an aviation specific test like the Versant Aviation English Test (VAET). Students with a background in aviation should be tested using the VAET. Students without an aviation background would struggle with the vocabulary and context of an aviation specific test. A generic English test should be used during the initial screening and a test like the VAET should be used at a later time to determine the students’ aviation English proficiency. Flight schools can ensure successful screening and student transition to the United States by having support programs in place to address their unique needs. Feng (1991) found that one of the biggest concerns for international student transition was moving from formal English to conversational English. Bifuh-Ambe (2009) found that one of the best ways to build conversational English skills was to socialize with the host culture. One way this was accomplished is to send university and flight school representatives to the foreign country to spend time teaching basic aviation knowledge such as systems, regulations, and technical aviation language and communications. Part of the time spent with the students in their country can also address culture shock issues that center on cultural rules and social interactions. Students who are educated about culture shock and ways in which to deal with it will be more successful in their respective social transition, collegiate academics, and flight training.

Given that significance was found between high oral English scores, VET scores, academic performance, and block 1 flight hours more research should be conducted to determine what other variables predict flight and academic success. Demographic data, spatial tests, instructor changes, number of lesson repeats, and flyable weather days are all examples of data that could be collected to determine if significance existed and increase the $R^2$. Motivation likely plays a large role in student success, but is a very difficult variable to assess.

The results indicate that English screening is an important part of the foreign student success puzzle, but that further research is needed to determine other variables that may play a factor in that success. Nevertheless school administrators should have a viable screening program in place with a long-term assessment plan to measure its reliability and validity. As flight schools in the United States continue to play a crucial role in training foreign pilots, it will be necessary to determine and test appropriate pre-screening techniques to ensure the success of the pilot applicants.

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**Elizabeth Bjerke** is an associate professor of aviation at the University of North Dakota. She also serves as the associate chair for the Department of Aviation. Elizabeth has a Ph.D. in Education Leadership, and focuses her research efforts on aviation education specifically student persistence and success. Elizabeth also holds a commercial pilot certificate with airplane single-engine land and sea, multi-engine land ratings, as well as a certified flight instructor certificate with airplane single and multi-engine, instrument airplane ratings.
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