0869

IN THE CALL CLASSROOM:

LEARNING STYLES AND STUDENT SUCCESS

IN SECOND LANGUAGE INSTRUCTION

by

MISTY HAMIDEH

A thesis submitted in partial fulfillment of the
requirements for the degree of

MASTER OF ARTS
in
TEACHING ENGLISH TO SPEAKERS OF OTHER LANGUAGES

Portland State University
2003

Students included in these numbers were those that volunteered to take part in the study by completing the online learning styles survey (see "Data Collection"). No sampling procedure was employed – all students who both agreed to participate and completed the survey were included in the participant group.

Data Collection

In order to answer the study research questions, it was first necessary to identify the learning styles of the students involved in the study. For this purpose, two weeks prior to the end of the term, students in all First-Year Spanish courses were asked to complete an online survey to determine their dominant learning style preference (view at: http://survey.oit.pdx.edu/ss/wsb.dll/mistyr/ls_survey.htm; a paper copy is also shown in Appendix A). As noted in the literature review, the learning style inventory chosen to make this determination was one developed by Dr. Marguerita McVay Lynch for her work in the field of online education (McVay, 2000b). While there is a plethora of instruments currently being used to determine a student's preferred learning style, this survey seemed ideal for the purposes of this research, as it was designed specifically for use with university students in the online environment. This online survey, which appeared as a link on the students' WebCT First-Year Spanish homepage, included sixty questions that asked students to identify typical learning behaviors on a three-point scale. For each learning behavior, they

were asked to identify whether the statement was true "most of the time," "sometimes," or "rarely," each response receiving a different amount of points ("most of the time" scored five points, "sometimes" three points, and "rarely" received one point). These scores were then categorized according to the type of prompt; for example, if the prompt was "I prefer listening to the new on the radio rather than reading about it in the newspaper," a student would receive points toward the *auditory* style (see the scoring guide in Appendix B). These totals, when put into the scoring guide (Lynch 2000b), identified their dominant learning style as auditory, visual, kinesthetic or any combination of these (as some students exhibited strengths in more than one modality). To contribute evidence toward the validity of the survey, Lynch asked 2,000 students to complete both this instrument as well as the Gardner Multiple Intelligence Survey, the results of which were compared to one another. This comparison led to a correlation coefficient of 0.82, providing one type of evidence for the validity of the survey (electronic mail, January 28, 2003). Additional questions were also added to the beginning of the survey that were geared at determining the general demographics of the participants (see the "Participants" section).

In addition to information about the students' learning styles, collection of data about the students' performance in their Spanish course was necessary. These data, already gathered and recorded by instructors for their own grading purposes,

required no additional collection efforts, although it was necessary to obtain permission from the ethical review board at Portland State University and the participants to retrieve and use this data. Included in these data were measures of student success in a variety of areas, including scores on individual assignments, major exams, and overall course grade.

Data regarding the students' performance in the classroom came primarily in the form of raw scores on individual assignments. The only measure of student success that was provided as a percentage was the overall course grade. The scores on individual assignments were subdivided into seven major categories for examination – listening activities, grammar activities, reading activities, asynchronous discussions, synchronous discussions, oral examinations and overall course grade. The following describes what was included in each of these sub-categories:

Listening

These activities were completed in the online environment and consisted of two kinds of activities:

- Programa de radio – Students were asked to listen to audio clips taken from Spanish radio and answer questions that assessed their comprehension.
- Modelos para converser – Audio clips of conversations between native speakers were presented then followed by a comprehension quiz.

Grammar

For each module, students were asked to complete 2 – 4 online grammar activities that covered only the information presented that week. Students received a grade for their first attempt at each activity.

Reading

A reading comprehension activity was also included in each module. These activities required students to read a short text about some element of Spanish culture and answer questions about the materials.

Asynchronous discussions

Every week, a topic was posted to the discussion board by the instructor. Students were required to post at least one message in response to this initial posting. Instructors would randomly respond to the content, but not accuracy, of students' messages. Postings were graded based primarily on content, but also on accuracy of language use.

Synchronous discussions

Students were also required to meet once per week with assigned groups for a chat session. During this time, students took part in a synchronous online discussion on a topic designated by the instructor in a text-based chat room. Like the discussion board, grades for this assignment reflected mostly content, but also accuracy of language use.

Oral Examinations

The oral examination consisted of a private interview between the instructor and each student. Although these interviews were not certified ACTFL interviews (ACTFL, 1985), they adhered to the same types of procedures and standards. The overall course grade took into account all of these measures, in addition to some not listed such as participation, in-class assignments and a final presentation.

Data Analysis

As described above, data collected from the learning styles survey was evaluated according to the scoring guide developed by Lynch (2000b). This guide assigned a certain number of points to each of the three possible responses (most of the time, sometimes, and rarely) depending on the prompt. Adding these points together for responses that reflected each of the learning modalities yielded three individual scores – one score each for auditory, visual and kinesthetic modalities. Based on these scores, it could be determined whether the student had a preference for one particular learning modality or multiple modalities. The highest score or set of scores reflected the student's learning style preference as one of the following:

- Auditory
- Visual
- Kinesthetic
- Auditory-Visual
- Visual-Kinesthetic
- Auditory-Kinesthetic
- Balanced

By assigning each student to one of these categories based on their scores, a total of seven groups of students were created. These groups represent the independent variables in this study.

In order to be able to compare the measures of success described in the previous section according to these groups, it was necessary to manipulate the data acquired from student records. In its raw form, these data were not uniform – points for each activity differed considerably making it difficult to analyze in relation to one another. To make the data more useful, each raw score was converted into a percentage and then subjected to non-parametric statistical analyses in this new form.

To make comparisons between the data described above, the Kruskal-Wallis test was first conducted to identify if significant differences in mean scores of each activity were found based on student learning style. This statistical test was chosen because the data collected for this study was not normally distributed, thus preventing the use of MANOVA tests. After it was determined which activities had significant differences by way of the Kruskal-Wallis test (by either supporting or refuting the null hypothesis that there are no significant group differences), a Mann-Whitney U test of significance was conducted to determine whether the differences in the sample data were truly significant or could have occurred by chance, thus establishing which specific learning styles might have more or less success with each of the activities. The specific means for each of the activity types was also determined

in order to ascertain how the means differed – that is, whether students in one learning style group did significantly better or significantly worse than another group.

The methods described above were designed to help this researcher determined whether or not students with certain learning style preferences would have an advantage in the computer-assisted language learning environment. The analysis of the data collected through these methods will be explained in great detail in the next chapter.

CHAPTER IV
RESULTS

In this chapter, the relationship between student learning styles and various measures of success in a computer-enhanced language learning classroom will be investigated. Through statistical analysis, the following questions will be examined: 1) to what extent do students with certain learning style preferences have success with specific language learning activities in a CALL environment, and 2) what is the relationship between learning style preferences and overall student success in CALL environments?

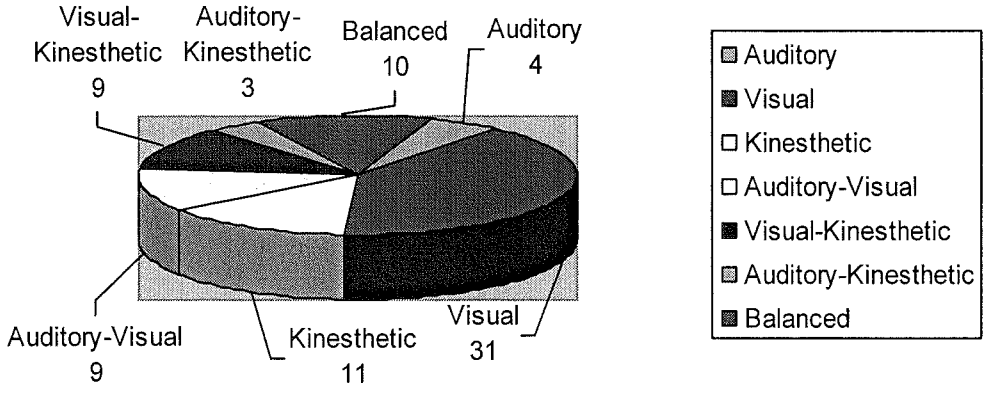
Learning Style Groups

Before any statistical analysis could be completed, it was necessary to determine the learning styles of each of the participants. This information was obtained through a learning style survey developed in 1997 and designed for use with students studying in the online environment (Lynch, 2000). The information gathered in this survey allowed students to be categorized into one of seven different learning style groups: auditory, visual, kinesthetic, auditory-visual, visual-kinesthetic, auditory-kinesthetic or balanced.

Based on the responses to sixty questions about the ways in which they learn, students were given different point values to reflect the extent to which they used the

modalities (auditory, visual and kinesthetic) that each question reflected. For a response of "most of the time," five points were given; the "sometimes" response was awarded three points; and "rarely" was allocated one point. The questions were then grouped together by the three basic modalities and the points for each response tallied, thus giving each student three scores (one for each modality). These scores were then compared to determine the learning style preference of the student, the greatest total representing the strongest learning style. In cases where the numbers were the same or within the margin of error, students were assigned to one of the learning style combination groups (auditory-visual, visual-kinesthetic, auditory-kinesthetic or balanced). These groups identify students who have strengths in more than one learning style. Figure 4.1 shows the distribution of learning style groups:

Figure 4.1 - Distribution of Learning Style Groups



As is apparent from the above chart, the vast majority of the participants fell into the visual learning style group. The least common groups were the auditory and

auditory-kinesthetic learning styles. The number of participants in the remaining four groups was roughly the same, ranging from nine to eleven.

Research Question 1

Does a student's learning style preference affect their success with specific language learning activities in the computer-assisted language learning environment?

In order to be able to compare the seven learning style groups to each other based on performance success, the median scores for each of the language learning activity types were determined. It was necessary to first convert the raw scores provided in the original data set to percentages to allow for comparisons throughout the analysis. These percentage scores, calculated from a total of seventy-one activities, were then grouped into seven different categories (the number in parenthesis indicates how many activities of each type were included in the analysis) – listening (16), grammar (22), reading (7), vocabulary (9), asynchronous discussions or online discussion board postings (8), synchronous discussions or online chat sessions (8), and oral examinations (1) - and further grouped by learning preference. Within these groupings, the median scores were calculated and used to reflect the overall success across all of the language learning activities for each of the seven learning style groups. While the mean score could have been used for purposes of comparison, the non-interval nature of the data and the non-normal distribution of

the scores suggested that the median score may be a more accurate representation of the overall level of success for any one leaning style group. Table 4.1 shows the medians and range for each of the activity types, categorized both by learning style group as well as for the entire participant population.

Table 4.1 - Median Scores and Ranges

Style		Listening	Grammar	Reading	Vocab	Asynch. Discussion	Synch. Discussion	Oral
A	median	91.00	89.00	65.00	91.50	89.00	96.50	92.50
	min	64.00	58.00	52.00	57.00	45.00	94.00	88.00
	max	100.00	91.00	91.00	100.00	99.00	100.00	100.00
V	median	89.00	84.00	79.00	93.00	86.00	86.00	83.50
	min	53.00	47.00	21.00	65.00	25.00	38.00	70.00
	max	96.00	98.00	97.00	100.00	100.00	100.00	100.00
K	median	85.00	63.00	52.00	72.00	59.00	75.00	78.00
	min	56.00	46.00	23.00	56.00	0.00	38.00	0.00
	max	94.00	82.00	73.00	96.00	100.00	100.00	100.00
AV	median	89.00	76.00	73.00	90.00	63.00	63.00	78.00
	min	56.00	38.00	24.00	56.00	23.00	28.00	58.00
	max	95.00	95.00	85.00	100.00	98.00	100.00	100.00
VK	median	86.00	75.00	61.00	79.00	59.00	76.00	90.00
	min	46.00	13.00	0.00	35.00	36.00	13.00	65.00
	max	99.00	98.00	91.00	94.00	96.00	93.00	98.00
AK	median	83.00	71.00	45.00	83.00	50.00	75.00	82.50
	min	78.00	51.00	15.00	71.00	49.00	49.00	80.00
	max	90.00	79.00	76.00	85.00	63.00	100.00	85.00
AVK	median	86.50	82.50	74.50	87.50	78.00	87.00	81.00
	min	54.00	17.00	14.00	38.00	25.00	15.00	48.00
	max	98.00	95.00	91.00	94.00	100.00	100.00	100.00
All	median	88.00	79.00	70.00	88.00	79.50	85.00	85.00
	min	46.00	13.00	0.00	35.00	0.00	13.00	0.00
	max	100.00	98.00	97.00	100.00	100.00	100.00	100.00

A = auditory **V** = visual **K** = kinesthetic **AV** = auditory-visual **VK** = visual-kinesthetic **AK** = auditory-kinesthetic **AVK** = balanced **All** = all 77 participants

In order to determine whether there were differences between the preferred learning style groups on the measures of success for the seven types of language learning activities, a Kruskal-Wallis test was used. As discussed above, because the data were non-interval and non-normal in their distribution, a nonparametric test was chosen. This test allowed for identification of the types of activities for which learning style would appear to influence achievement. The null hypothesis for this test was that student success would be equal in all learning style groups. The alpha level for all statistical tests used in this research was set at .05; therefore, a p-value of less than 0.05 would refute the null hypothesis, supporting the alternative hypothesis that the relationship between the level of success and student learning style in at least two of the different learning style groups for the given activity was significantly different. Table 4.2 shows the results of these initial Kruskal-Wallis tests:

Table 4.2 - P-values for Group Comparisons

Activity	p-value
Listening	0.767
Grammar	0.114
Reading	**0.031**
Vocabulary	**0.017**
Synchronous Discussions	**0.030**
Asynchronous Discussions	0.158
Oral Examination	0.504

where $\alpha = .05$

As this analysis employed the use of non-parametric tests, which are generally more conservative in nature, the traditional alpha level of 0.05 was used. A more conservative analysis might have adjusted the p-value to account for the multiple comparisons included in this analysis, as is often done when using inferential statistics, resulting in a recalculated p-value equal to 0.007. In this case, none of the above activity outcomes would have shown statistical significance between the seven learning style groups. However, because these non-parametric tests are, in fact, more conservative in their analysis of the data, this researcher chose to use the field-accepted 0.05 alpha level standard. (This issue will be further discussed in Chapter 5.) With this in mind, the data included in this table suggest that student success in three of the seven language learning activities – reading, vocabulary, and synchronous discussions – differed significantly when the seven learning style groups were compared against each other. On the other hand, students' success in the listening, grammar, asynchronous discussion activities and the oral examination showed no significant differences in success based on their learning style preference group.

In those areas where a difference was noted, the above data still leaves unanswered the question of which learning styles excel in these activities. To determine specifically which learning style groups differed in achievement for these three activities, Mann-Whitney U tests of significance were conducted between each

of the learning style group pairs. The following sections show the p-values that were produced from these tests as well as a brief explanation of the results.

Reading activities

One type of activity identified by the Kruskal-Wallis tests as having a statistically significant relationship between student success and learning style was the reading activities. In order to identify where the differences among groups were found, a Mann-Whitney U test of significance was conducted. Table 4.3 shows the resulting p-values of these comparisons:

Table 4.3 - Group Comparisons for Reading Activities

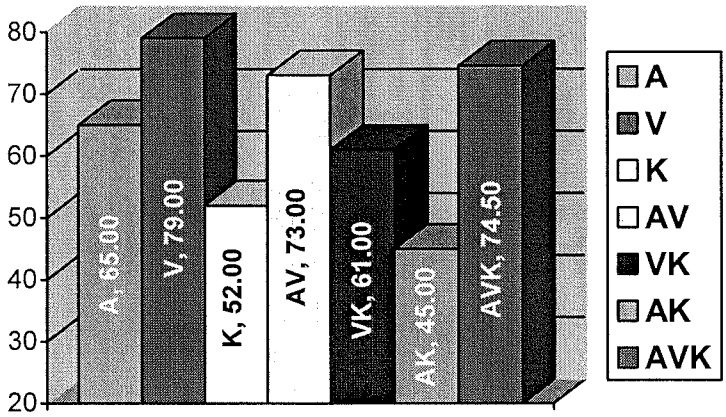
Reading	A	V	K	AV	VK	AK
V	0.419					
K	0.190	**0.001**				
AV	0.877	0.242	0.073			
VK	0.589	0.062	0.542	0.535		
AK	0.289	0.059	0.938	0.164	0.782	
AVK	0.887	0.273	0.129	0.967	0.413	0.234

where $\alpha = 0.05$

As can be seen in the above table, significant differences in student success of the reading activities were detected only between visual and kinesthetic learners. Although not statistically significant, it may also be important to note that the comparison between the visual learners and the two other learning style groups with tendencies toward kinesthetic learning (i.e. visual-kinesthetic and auditory-

kinesthetic) resulted in relatively low p-values. In order to determine how these groups differed, the median scores for each group were considered (see Figure 4.2).

Figure 4.2 - Median Scores for Reading Activities



In comparing the median scores of all seven groups, it can be seen that the visual learners appear to score higher on the reading activities than all other learning styles. As the above p-values suggest, the difference between visual and kinesthetic learners is especially great, with a difference in median scores of 27 points.

Vocabulary Activities

The above statistical analysis also showed that there were significant differences between learning style preference groups on success in vocabulary activities. To ascertain which learning style groups had significantly different scores on this particular measure, the Mann-Whitney U test of significance was again utilized. Table 4.4 shows the resulting p-values:

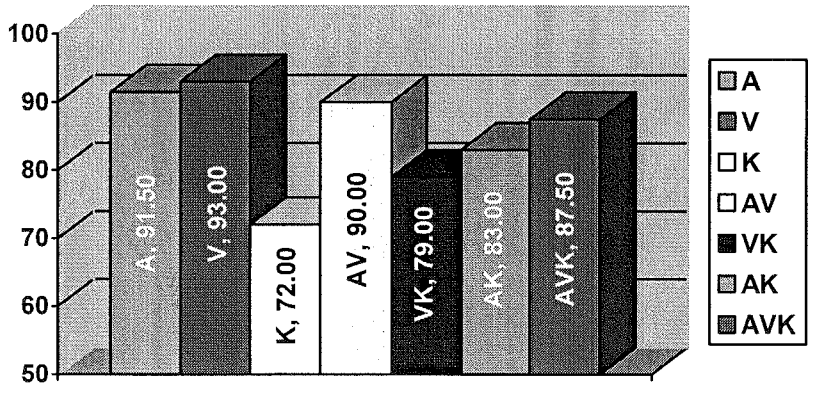
Table 4.4 - Group Comparisons for Vocabulary Activities

Vocabulary	A	V	K	AV	VK	AK
V	0.959					
K	0.266	**0.002**				
AV	0.699	0.603	0.087			
VK	0.216	**0.009**	0.790	0.122		
AK	0.289	0.077	0.349	0.228	0.781	
AVK	0.355	0.123	0.138	0.652	0.286	0.202

where $\alpha = 0.05$

The p-values found in the above test suggest that two of the group comparisons showed a significant difference in student success - the visual with the kinesthetic learners and the visual with the visual-kinesthetic learners. Again, the actual median scores were consulted to determine how these groups differed (see Figure 4.3):

Figure 4.3 - Median Scores for Vocabulary Activities



What these values show us is that, similar to the reading activity findings, the visual learners achieved, on average, higher scores than some of the other learning style groups. Specifically, they tended to have more success than the kinesthetic and

visual-kinesthetic learners. Also, although not marked as statistically significant, Figure 3 shows that the median score for the auditory-kinesthetic learners was also low with respect to not only the visual learners, but also the auditory, auditory-visual and balanced learners. As with the reading activities, learners with some inclination toward one of the kinesthetic-type learning styles tended not to do as well as students with other learning style preferences.

Synchronous Discussions

Student success on the synchronous activities (online chat sessions) were also shown to be statistically significantly different between the seven learning style groups. As with the previous two measures, a Mann-Whitney U test was performed to determine where these differences occurred. The p-values resulting from this test are presented in Table 4.5.

Table 4.5 - Group Comparisons for Synchronous Discussion Activities

Synchronous Discussions	A	V	K	AV	VK	AK
V	0.095					
K	0.049	0.092				
AV	0.122	0.241	0.703			
VK	**0.005**	0.082	0.820	0.596		
AK	0.372	0.561	0.814	0.578	0.644	
AVK	0.065	0.691	0.273	0.567	0.391	0.798

where $\alpha = 0.05$

Research Question 2

What is the relationship between learning style preferences and overall student success in CALL environments?

The above data show that there appears to be differing amounts of success on specific types of activities in the computer-assisted language learning classroom. The second research question, however, addresses students' overall success in the course in relation to their learning style. The measure of overall success that is being used for this study is the final grade that the students received for their work in the course. This grade includes all of the activities listed in the above section, but also includes a number of other factors, including classroom participation, group presentations and some other in-class activities.

In order to begin making these comparisons, it was first necessary to look at the final median scores for each of the seven learning style groups, a score which would include all required activities (see Chapter 3 for more detail). Table 4.6 includes these data:

Table 4.6 - Median Scores for Each Learning Style Group

Learning Style	Median Score
Auditory	94.000
Visual	90.000
Kinesthetic	82.000
Auditory-Visual	79.000
Visual-Kinesthetic	84.000
Auditory-Kinesthetic	79.000
Balanced	88.500

The same test used to compare the means of specific language learning activities, the Kruskal-Wallis test, was again conducted to determine whether or not the difference in these median scores were statistically different. The results of this test showed the p-value to be equal to 0.132. Based on an α-value of 0.05, this difference would not be significant, thus supporting the null hypothesis that suggests that the means do not vary due to anything other than chance.

In summary, the analysis included in this chapter suggests that, although there do appear to be differences between learning style preference groups on individual language learning activities, differences in the learning style preferences do not seem to be related to differences in overall success in the computer-assisted language learning environment being investigated in this study. The impact of these results on the field of CALL will be further discussed in the next chapter.

CHAPTER V
DISCUSSION

The results reported in the previous chapter suggest that learning style may, to some extent, play a role in student success in the computer-assisted language learning classroom. This chapter will examine the data more closely with respect to the research questions in an attempt to better understand these relationships. In addition, the possible limitations of the study will be proposed, as well as some suggestions for further research in this area.

Research Question 1

Does a student's learning style preference affect their success with specific language learning activities in the computer-assisted language learning environment?

This first question looks at the role a student's learning style plays in relation to a number of different measures, thus making it difficult to answer in one simple statement. The results presented in the last chapter actually show that while the success some students have with specific language learning activities may be due to learning style differences, other activities produce no difference in outcomes from all types of students, regardless of their learning style.

The data collected from this group of participants suggests that none of the learning style groups identified for this research have an advantage over other

learning style groups on the majority of the language learning activities, specifically the listening, grammar, asynchronous discussion and oral activities (see chapter 2 for more detail about these types of activities). Conversely, the three other categories of activities – reading, vocabulary and synchronous discussions – show that differences between at least two of the learning styles may be statistically significant. Table 5.1 provides an overview of these comparisons.

Table 5.1 - Overview of Comparisons

Learning Style	Activities where achievement was significantly higher than at least one other group	Activities where achievement was significantly lower than at least one other group
Auditory	Synchronous discussions	*None*
Visual	Reading Vocabulary	*None*
Kinesthetic	*None*	Reading Vocabulary
Auditory-Visual	*None*	*None*
Visual-Kinesthetic	*None*	Vocabulary Synchronous discussions
Auditory-Kinesthetic	*None*	*None*
Balanced	*None*	*None*

What the results suggest is that auditory and visual learners may have an advantage over at least some other types of learners on a select number of activities

required in a technology-enhanced language classroom. On the other hand, kinesthetic and visual-kinesthetic learners seem to have more trouble than some other learners with certain activity types.

As for the above research question, the answer appears to be yes and no – in the case of some types of learning activities, learning style does seem to play a role in student success, while other activity types are not at all impacted by this variable. Based on this researcher's experience in the field of second language acquisition, this outcome was expected. Each of the language learning activities included in the analysis require very different skills, and as such, it is logical to assume that the way a student approaches the materials (i.e. their learning style) might affect their success. The fact that learners with kinesthetic modality strengths (i.e. kinesthetic, auditory-kinesthetic and visual-kinesthetic) had more trouble with some of the activities was also anticipated. Research has shown that, in the online environment, kinesthetic learners seem to have the greatest amount of difficulty (McVay, 2000b). In order for these types of learners to do well in this environment, they often have to rely on less preferred modalities and use strategies with which they are not as comfortable.

However, as was mentioned in the previous chapter, a more conservative researcher using a recalculated alpha level to account for the multiple comparisons considered in this study may have found that even the few differences cited above were not actually statistically significant and instead due only to chance. In this case,

it would support the belief of many distributed learning advocates that the computer-assisted language learning environment does not provide advantages to students with a particular learning style preference. Whichever analysis one chooses to accept, the conservative or the more liberal, it does appear that the vast majority in this CALL environment have the same potential for success as their classmates, regardless of their preferred learning style.

Research Question 2

What is the relationship between learning style preferences and overall student success in CALL environments?

The overall grades of students in this computer-assisted language learning classroom were not statistically significant based on student learning style. This indicates that learning style preference does not impact the overall success of students in the CALL classroom. Extensive involvement in the development of the online materials used for the course in question led this researcher to predict this outcome. From the beginning of the project, the importance of creating materials that would benefit all types of learners was emphasized – thus, each chapter includes presentations and activities that have the potential to stimulate multiple learning styles. Every chapter contains audio clips, interactive practice exercises and graphics to help enhance the presentation of the lesson. Because the construction of the course took into consideration the many kinds of learners that would take part in the

instruction, it was expected that a student's learning style would not affect their success in the course overall.

Implications

The findings of this study support the belief of many CALL advocates that computer-assisted instruction provides all types of students with the opportunity to succeed in language learning. This idea is of particular importance in the field of education today, as many educators are being required by their institutions to implement these kinds of technological tools in their own classrooms. While some are eager to begin using CALL techniques, many language educators are apprehensive about its effect on the learning environment.

Although this study does not claim to prove the ability of CALL to provide equal opportunity to all students, it does suggest that this might be the case. For instructors at Portland State University that are being required to use these materials, these findings may provide them with the evidence they need to feel comfortable with the idea this learning environment truly is beneficial to the language learning environment as a whole. To other institutions that are considering a similar move towards technology in the language classroom, the outcomes of this study may cause more traditional language instructors to see the potential advantages of the computer-assisted language learning classroom.

This type of research is still relatively new to the field of second language acquisition, but the results imply that a CALL classroom may more adequately serve the greater student population. This is should no doubt be further investigated, but advocates of computer-assisted language learning should consider promising the findings presented in this paper.

Limitations

While the outcomes of the research make some interesting implications about the relationship between student learning styles and success in the computer-assisted language learning environment, there are some limitations inherent in the study.

To begin, it is important to recognize the difficulty in simply trying to determine the learning style of an individual. There is no absolute way to tell how a student is absorbing new information – inventories like the one administered in this study only identify the *perceived* learning style of a student, giving us information about how they think they typically learn best. While this may seem to discount the research using this type of information, it should also be noted that most of the surveys used to identify learning styles take this fact into consideration, asking questions in such a way that the responses yield a more accurate picture of the individual's preferred mode of learning.

Another potential limitation of this study is the fact that we are not able to generalize about all language learners in CALL classrooms. Because only a select number of students from one institution were investigated in this study, it makes it difficult to generalize about language learners in this type of learning environment. While this is true, the analysis of this group of students does still make a contribution to a field lacking in such research. The information presented in this study should inform others who are interested in similar topics and will add a body of data to the field.

The analysis of the data required that students identify themselves on the learning styles survey – this lack of anonymity may have also negatively affected the results of the survey as well as the number of participants that volunteered to be studied. To combat this possibility, surveys were administered in the least obtrusive manner, through a link on their online course homepage that could be accessed at any time during the last two weeks of fall term, and students were assured that the data would not be recognizable to anyone outside of the research team. Students were also given a clear picture of the research being conducted through classroom presentations (as shared knowledge should not greatly impair outcomes) and were made aware of the benefits of the study. However, of the over 150 students enrolled in these redesigned Spanish courses, only 77 chose to participate. While it is difficult

to ascertain why certain students chose not to volunteer, it is possible that this sampling is not representative of the entire population.

Another issue is that of the technological skills of the participants. While all students were made aware of the online component of the course and given ample opportunity to seek technical assistance from any of the Spanish instructors, it is possible that students' technical skills may have impacted their scores on the measures included in this study. Although the materials included in the online presentation were not particularly technologically advanced, it was apparent in even the first week of the term that some students were having difficulty maneuvering though the online portion of the lesson and completing the computer-based activities successfully. In future studies of this nature, it may be advantageous to get a more detailed picture of the technical skills of the students involved.

Recommendations for Further Study

Research in the field of computer-assisted language learning is very limited. In addition, this type of instruction is relatively new to the field of education and the technology that drives CALL classrooms is constantly changing, making the standards of computer-assisted instruction ever-changing. In the opinion of this researcher, additional research on any aspect of CALL environments would be of

great benefit to the field. However, there are a few areas that seem to warrant specific attention.

One area of particular interest is how students with certain learning styles fare in the CALL environment over time. The timeframe of this study spanned only ten weeks; most other studies in this area have also only concentrated on one term of study, while others have limited the examination to two-hour training courses (Aragon, Johnson & Shaik, 2000; Ester, 1994; Loomis, 2000; Ross & Schultz, 1999; Soo & Ngeow, 1998). These studies that have shorter time spans leaves a potential for many unaccountable variables, like technological skill level, prior experience with learning materials and other environmental factors. More conclusive research as to the effect of an individual's learning style on their success in technology-enhanced learning environments might include tracking achievement over time. This type of long-term study may provide more information about whether a student's learning style helps them to learn materials more quickly and effectively.

Additionally, studies similar to the one presented in this paper should be conducted with the use of other measures of success. The main goal of this project was to determine if all students were being well-served by the materials included in this CALL course. However, information about universal proficiency levels and other more standard measures of achievement may help to make the results more notable to language educators. Reporting that all students achieved comparable

marks on vocabulary exercises designed by Portland State University faculty does not have the same impact as would ACTFL oral proficiency scores to educators around the nation.

One final area that deserves more attention is the comparison of CALL classrooms with traditional classrooms. Many now realize that the traditional, teacher-fronted, lecture-based classroom does not serve all students, and the technology-enhanced classroom is being supported as an optimum alternative to the conventional methods. However, research that investigates how to implement technology in the most effective way to reach learners of all types is still greatly needed in the field, especially for language learning classrooms.

In this age of technology, it is easy for instructors to simply take these new educational tools and try to fit them into their existing lessons. However, as previous research has already concluded, "the effectiveness of educational technology depends on how it is employed to meet educational goals for particular kinds of students in specific language learning environments" (Oxford, Rivera-Castillo, Feyten & Nutta, 1998). By identifying the relationship between learning style preference and individual success in the technology-enhanced classroom, we will be better able to develop online curricula that better serves all of tomorrow's students. It is hoped that the information gathered by this research study will help the field of CALL to

determine how to create online tools that reach learners of all types and identify how to better prepare students to use them.

REFERENCES

American Council for the Teaching of Foreign Languages (ACTFL). 1985. *ACTFL proficiency guidelines (rev. Ed.).* Hastings-on-Hudson, NY: ACTFL Materials Center [available online: http://www.sil.org.lingulinks/languagelearning/othersources/actflproficiency guidelines/contents.htm].

Aragon, S. R., Johnson, S. D. & Shaik, N. (2000, October 30-November 4). *The influence of learning style preferences on student success in online vs. face-to-face environments.* Paper presented at the WebNet 2000 World Conference on the WWW and Internet Proceedings, San Antonio, Texas. ERIC Document Reproduction Service No. ED 448 745.

Bates, A. W. (1995). *Technology, open learning and distance education.* London: Routledge.

Brown, H. D. (1994). *Teaching by principals: an interactive approach to language pedagogy.* Upper Saddle River, NJ: Prentice Hall Regents.

Chamot, A. U., Barnhardt, S., El-Dinary, P. B. & Robbins, J. (1999). *The learning strategies handbook.* White Plains, NY: Longman.

Chapelle, C. (2001). *Computer applications in second language acquisition: foundations for teaching, testing and research.* Cambridge, UK: Cambridge University Press.

Claxton, C. S. (1987). *Learning Styles: implications for improving educational practices.* Washington, D.C.: Association for the Study of Higher Education.

Cornett, C. (1983). *What you should know about teaching and learning styles.* Bloomington, IN: Phi Delta Kappa Educational Foundation.

Diaz, D. P. & Cartnal, R. B. (1999). Students' learning styles in two classes: online distance learning and equivalent on-campus teaching. *College Teaching, 47*(4), 130-135.

Ester, D. P. (1994). CAI, lecture, and student learning style: the different effects of instructional method. *Journal of Research on Computing in Education, 27* (2), 129-140.

Felder, R. M. (1995). Learning and teaching styles in foreign and second language education. *Foreign Language Annals. 28*(1), 21-31.

Geisert, G., Dunn, R. & Sinatra, R. (1990). Reading, learning styles, and computers. *Journal of Reading, Writing and Learning Disabilities,* 6, 297-305.

Grasha, A. F. & Yangarber-Hicks, N. (2000). Integrating teaching styles and learning styles with instructional technology. *College Teaching, 48*(1), 2-10.

Harrell Jr., W. (1999). Language learning at a distance via computer. *International Journal of Instructional Media, 26*(3), 267-281.

Kulik, J. A., Kulik, C. C. & Cohen, P. (1980). Effectiveness of computer-based college teaching: a meta-analysis of findings. *Review of Educational Research,* 50, 525-544.

Lemire, D. (2002). Brief report: what developmental educators should know about learning styles and cognitive styles. *Journal of College Reading and Learning, 32*(2).

Lewis, A. C. (1991). *Learning styles: putting research and common sense into practice.* Arlington, VA: American Association of School Administrators.

Loomis, K. D. (2000). Learning styles and asynchronous learning: comparing the LASSI model to class performance. *Journal of Aynchronous Learning Networks, 4*(1).

Lynch, M. M. (2002). *The online educator: a guide to creating the virtual classroom.* New York, NY: RoutledgeFalmer.

McVay, M. (2000a). Developing a web-based distance student orientation to enhance student success in an online bachelor's degree completion program. (Doctoral dissertation. Nova Southeastern University, 2000).

McVay, M. (2000b). *How to be a successful distance learning student : learning on the internet.* Boston, MA: Pearson Custom Publishing.

Oxford, R. L. (1990). *Language learning strategies : what every teacher should know.* New York: Newbury House Publishers.

Oxford, R. L., Rivera-Castillo, Y., Feyten, C. & Nutta, J. (1998). *Computers and more: creative uses of technology for learning a second or foreign language.* Retrieved February 8, 2002 from the World Wide Web: http://www.insa-lyon.fr/Departments/CDRL/computers.html.

Price, G. (1989). An historical perspective on the design of CAI: lessons from the past. *Computers in the Schools,* 6, 145-157.

Reid, J. (Ed.). (1998). *Understanding learning styles in the second language classroom.* Upper Saddle River, NJ: Prentice Hall Regents.

Reiff, J. (1992). *Learning Styles.* Washington, D.C.: National Education Association.

Ross, J. & Schultz, R. (1999). Can computer-aided instruction accommodate all learners equally? *British Journal of Educational Technology,* 30(1), 5-24.

Schmeck, R. (Ed.). (1998). *Learning strategies and learning styles.* New York, NY: Plenum Press.

Sims, R. & Sims, S. (Eds.). (1995). *The importance of learning styles: understanding the implications for learning, course design, and education.* Westport, CT: Greenwood Press.

Smith, S. M., & Woody, P. C. (2000). Interactive effect of multimedia instruction and learning styles. *Teaching of Psychology, 27*(3), 220-224.

Snyder, R. F. (2000). The relationship between learning styles / multiple intelligences and academic achievement of high school students, *The High School Journal.* 83(2), 11-20.

Soo, K. S. (1999). Theory and research: learning styles, motivation, and the CALL classroom. In J. Egbert & E. Hanson-Smith (Eds.), *CALL environments: research, practice, and critical issues.* (pp. 289-301). Alexandria, VA: Teachers of English to Speakers of Other Languages, Inc.

Soo, K. S. & Ngeow, Y. H. (1998). Effective English as a second language (ESL) instruction with interactive multimedia: the MCALL project. *Journal of Educational Multimedia and Hypermedia, 7*(1), 71-89.

Tchaicha, J.D. (1999). Technology and the second language learner: how does it work best? In R. Debski & M. Levy (Eds.), *World CALL: global perspectives on computer-assisted language learning.* (pp. 287-302. Lisse, The Netherlands: Swets & Zeitlinger.

Twigg, C. (2000). Improving learning & reducing costs: redesigning large-enrollment courses. [World Wide Web page]. Available: http://www.center.rpi.edu/PewSym/mono1.html (2 Feb 2003).

Warschauer, M. (1997). Computer-mediated collaborative learning: theory and practice. *The Modern Language Journal, 81,* 470-481.

APPENDIX A - *Learning Styles Survey*

You are invited to participate in a research study conducted by a team of faculty led by Professor Robert Sanders of the Department of Foreign Languages and Literatures at Portland State University. This team hopes to find out how effective the First-Year Spanish program is and learn about the population of the students enrolled in this program.

Part of this study includes determining how students with differing learning styles fare in the computer-assisted language learning environment. The following survey will help us to determine what your dominant learning style is. This information will then be compared with the other measurements being taken for this study to determine if learning style does indeed play a role in the success of language learners in the online environment.

Your participation is voluntary. You do not have to take part in this study, and it will not affect your course grade or your relationship with your instructor at Portland State University. You may also withdraw from this study at any time without affecting your course grade or your relationship with your instructor at Portland State University.

○ Yes, I wish to take part in this study.

○ No, I do not wish to take part in this study.

Please begin by answering the following questions about yourself:

Your student ID number (or Social Security number):

Format: 999-99-9999

Your gender:

Your ethnicity:

Your age group:

Your class standing:

Your intended major:

After each statement, click on the button that best matches your situation. *Remember: There are no right or wrong answers.* Because most people learn through a mixture of all three styles, it is not unusual to have answers reflecting each of the styles. When you have completed the survey, click the "submit" button at the bottom of the screen.

1) If I have to learn how to do something, I learn best when I watch someone show me how.

most of the time sometimes rarely

2) When I read, I often find that I read out loud or hear the words inside by head.

most of the time sometimes rarely

3) I can understand and follow directions on maps.

most of the time sometimes rarely

4) I prefer to write with a pen or pencil, so I can feel the flow of the words or letters as I make them.

most of the time sometimes rarely

5) I would rather tell how something works than write how it works.

most of the time sometimes rarely

6) I prefer to use posters, models, or actual practice and some activities in class.

most of the time sometimes rarely

7) If I had to remember a list of items, I would remember it best if I said them over and over to myself.

most of the time sometimes rarely

8) When trying to concentrate, I have a difficult time when there is a lot of clutter in the room.

most of the time sometimes rarely

9) When asked to give directions, I have to point or move my body as I give them.

most of the time sometimes rarely

10) When learning, I prefer information to be written on the board along with visual aids and assigned readings.

most of the time sometimes rarely

11) If I am unsure how to spell a word, I spell it out loud in order to determine if it sounds right.

most of the time sometimes rarely

12) I prefer teachers who assign hands-on activities.

most of the time sometimes rarely

13) When trying to remember someone, I recall their face but forget their name.

most of the time sometimes rarely

14) To keep occupied while waiting for half an hour, I walk around or move my feet and legs as I sit.

most of the time sometimes rarely

15) If I had to describe a concept to someone else, I would go into great detail and talk at length.

most of the time sometimes rarely

16) I can remember more about a subject through the lecture method with information, explanations and discussion.

most of the time sometimes rarely

17) I am good at doing jigsaw puzzles.

most of the time sometimes rarely

18) I do math by counting on my fingers.

most of the time sometimes rarely

19) I can better understand a news item by reading about it in the paper than by hearing it on the radio.

most of the time sometimes rarely

20) I enjoy working with my hands or making things.

most of the time sometimes rarely

21) When solving a problem, I write or draw diagrams to see it.

most of the time sometimes rarely

22) When trying to concentrate, I have a difficult time when there is a lot of noise in the room.

most of the time sometimes rarely

23) When asked to give directions, I have no difficulty in giving them verbally.

most of the time sometimes rarely

24) If I had to remember a list of items, I would remember it best if I used my fingers to name each item.

most of the time sometimes rarely

25) When I read, I often find that I can picture what I am reading in my imagination.

most of the time sometimes rarely

26) I play with coins or keys in my pocket.

most of the time sometimes rarely

27) I learn to spell better by repeating the words out loud than by writing them on paper.

most of the time sometimes rarely

28) When given written instructions on how to build something, I try to put the parts together first and then read later if I get into trouble

most of the time sometimes rarely

29) When trying to remember someone, I recall the name, but forget their face.

most of the time sometimes rarely

30) If someone tried to give me verbal directions, I would try to visualize what she was saying or draw a map as she spoke.

most of the time sometimes rarely

31) When solving a problem, I talk myself through it.

most of the time sometimes rarely

32) If I have to learn something new, I learn best when I try to do it myself first.

most of the time sometimes rarely

33) When I write, I am concerned how neat and well designed my paper is.

most of the time sometimes rarely

34) I easily recognize a tune when I hear it again.

most of the time sometimes rarely

35) I do better at academic subjects by listening to lectures and tapes.

most of the time sometimes rarely

36) I obtain information on a subject by reading relevant materials.

most of the time sometimes rarely

37) While talking on the phone, I use gestures and move around.

most of the time sometimes rarely

38) To keep occupied while waiting half an hour, I talk or listen to others.

most of the time sometimes rarely

39) When trying to remember someone, I recall the situation in which I met the person, but not their name or face.

most of the time sometimes rarely

40) When solving a problem, I use my entire body or move objects around to help me think.

most of the time sometimes rarely

41) When given written instructions on how to build something, I read them silently and try to visualize how the parts will fit together.

most of the time sometimes rarely

42) If I have to learn something new, I learn best when I hear someone tell me how to do it.

most of the time sometimes rarely

43) If I had to remember a list of items, I would remember best if I wrote them down.

most of the time sometimes rarely

44) I prefer teachers who talk with a lot of expression.

most of the time sometimes rarely

45) When asked to give directions, I see the actual places in my mind as I saw them.

most of the time sometimes rarely

46) If I am unsure how to spell a word, I write it in order to determine if it feels right.

most of the time sometimes rarely

47) To keep occupied while waiting half an hour, I look around, stare, or read.

most of the time sometimes rarely

48) If someone were verbally describing a concept to me, I would become bored if the description became too detailed.

most of the time sometimes rarely

49) When I write, I say the word or sentences to myself.

most of the time sometimes rarely

50) When trying to concentrate, I have a difficult time when I have to sit still for any length of time.

most of the time sometimes rarely

51) If I am unsure how to spell a word, I write it in order to see if it looks right.

most of the time sometimes rarely

52) I like to outline my school work.

most of the time sometimes rarely

53) I speak better than I write.

most of the time sometimes rarely

54) When given written instructions on how to build something, I read them out loud and talk to myself as I put the parts together.

most of the time sometimes rarely

55) I remember best by writing things down several times.

most of the time sometimes rarely

56) I chew gum, smoke, or snack during studies.

most of the time sometimes rarely

57) I prefer listening to the news on the radio rather than reading about it in the newspaper.

most of the time sometimes rarely

58) I feel comfortable touching others, hugging, handshaking, etc.

most of the time sometimes rarely

59) If I had to describe a concept to another person, I would draw a model or chart to get my point across.

most of the time sometimes rarely

60) I write better than I speak.

○ most of the time ○ sometimes ○ rarely

Thank you very much for participating in this research! If you would like to know the results of your survey, please include your email address in the space provided below before submission:

Email address: _____

This survey was developed by Dr. Marguerita McVay Lynch, an Instructional Support Specialist in the Department of Instruction and Research Services here at Portland State University and an expert in the field of distributed learning.

Submit Survey

This survey was created with WebSurveyor

APPENDIX B - *Learning Styles Survey Scoring Guide*

Each item is given a point value based on your answer.

Most of the time = 5 points
Sometimes = 3 points
Rarely = 1 point

Each number below needs a point value based on the above scoring system. Write the point value on the line corresponding to the item number. You may wish to use a ruler or piece of paper to ensure you are following the line straight across to the associated item. Add the points in each column to obtain the preference scores under each category. You will calculate a subtotal for each page, then a final total for the entire inventory.

Item Number	Auditory	Visual	Kinesthetic
1		_____	
2	_____		
3		_____	
4			_____
5	_____		
6			_____
7	_____		
8		_____	
9			_____
10		_____	
11	_____		
12			_____
13		_____	
14			_____
15	_____		
16	_____		
17		_____	
Subtotal Scores 1:			

Item Number	Auditory	Visual	Kinesthetic
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
Subtotal Scores 2:			

Item Number	Auditory	Visual	Kinesthetic
44			
45	_____		
46		_____	
47			_____
48		_____	
49			_____
50	_____		
51			_____
52		_____	
53		_____	
54	_____		
55	_____		
56			_____
57			_____
58	_____		
59			_____
60		_____	
		_____	
Subtotal Scores 3:			

Record all your subtotal scores on the appropriate lines below, then add each column to receive your final scores according to category.

	Auditory	Visual	Kinesthetic
Subtotal Scores 1:	_____	_____	_____
Subtotal Scores 2:	_____	_____	_____
Subtotal Scores 3:	_____	_____	_____
Total Scores:	_____	_____	_____

McVay, M. (2000). *How to be a successful distance learning student : learning on the internet.* Boston, MA: Pearson Custom Publishing. (Used with permission.)

TABLE OF CONTENTS

LIST OF TABLES iii

LIST OF FIGURES iv

INTRODUCTION 1

Background Information 2
Author's Involvement 5
Summary 6

LITERATURE REVIEW 7

Introduction 7
Learning Style Theory 7
Computer-Assisted Instruction 12
Computer-Assisted Language Learning 15
Conclusion 19
Research Questions 19

METHODOLOGY 21

Setting 21
Participants 25
Data Collection 27
Data Analysis 31

RESULTS 34

Learning Style Groups 34
Research Question 1 36
Research Question 2 45

DISCUSSION 47

Research Question 1 47
Research Question 2 50
Implications 51
Limitations 52
Recommendations for Further Study 54

REFERENCES 58

APPENDIX A - *LEARNING STYLES SURVEY* 63

APPENDIX B - *LEARNING STYLES SURVEY SCORING GUIDE* 71

LIST OF TABLES

Table 3.1 - Outline of Online Learning Modules.....24

Table 3.2 - Demographic Data for Participants.....26

Table 4.1 - Median Scores and Ranges.....37

Table 4.2 - P-values for Group Comparisons.....38

Table 4.3 - Group Comparisons for Reading Activities.....40

Table 4.4 - Group Comparisons for Vocabulary Activities.....42

Table 4.5 - Group Comparisons for Synchronous Discussion Activities.....43

Table 4.6 - Median Scores for Each Learning Style Group.....45

Table 5.1 - Overview of Comparisons.....48

LIST OF FIGURES

Figure 4.1 - Distribution of Learning Style Groups.....35

Figure 4.2 - Median Scores for Reading Activities.....41

Figure 4.3 - Median Scores for Vocabulary Activities.....42

Figure 4.4 - Median Scores for Synchronous Discussion Activities.....44

CHAPTER I
INTRODUCTION

Technology is becoming a driving force in the world of education. With the number of multimedia tools available to today's educators rapidly on the rise, more and more research is being conducted to both assess the potential benefits of a technology-enhanced classroom and determine how to effectively use these technological tools to enhance the learning experience of students. However, despite this increasing interest in the field of technology-enhanced learning environments, many questions remain unanswered about the relationship between technology and learning.

Much of the literature that currently exists focuses on how educators might integrate today's online tools into a more traditional educational setting. Yet, while these researchers are identifying protocols for the successful development and integration of these tools, there has been seemingly little investigation into how these technological tools might impact the many types of learners that are present in the classroom. Understanding how these differences might influence the success of individual students is crucial to both assisting educators in creating more effective learning environments and in helping them to better prepare students for the technology they will continue to face in the future.

Following the research done by Loomis (2000), Ester (1994) and Aragon et al (2000) that looked at the relationship between learner characteristics and success in content courses, the study presented in this paper looks at the relationship between students' learning style preferences and their success in the computer-assisted language learning (CALL) classroom.

Background Information

The lack of information about the relationship between technology and learning has prompted the creation of a number of grants to fund research. One such grant was established by the Center for Academic Transformation at Rensselaer Polytechnic Institute. With support from the Pew Charitable Trust Foundation, the Center for Academic Transformation founded the Pew Grant Program in Course Redesign, a six million dollar award program that would provide funding for thirty large-scale course redesigns (Twigg, 2000). The purpose of initiating these redesigns was to determine how institutions could reduce the cost of course offerings while also increasing the quality of instruction through the use of technological tools in the course curriculum.

The courses chosen by the Pew Grant Program to receive funding for the redesign initiative were all introductory courses at institutions around the nation with large enrollment in a variety of fields. These courses are especially problematic

in institutions of higher education as the number of students interested in taking the course (usually because of specific program requirements) far exceeds the number of students the university is capable of serving. In the end, many students have to wait multiple terms to enroll in the course; and when they finally are able to register, they are frequently faced with an overcrowded class that provides little interaction and personal attention from the instructor. The creators of the Pew Grant Project believe that it is these types of courses that could most benefit from the integration of technological tools to increase the students' interaction with the learning materials (Twigg, 2000).

The Department of Foreign Languages and Literature at Portland State University has long faced these types of enrollment issues in the First-Year Spanish language program. In view of this, the Center for Academic Transformation found this course series to be an ideal candidate for the Pew Grant Project. Second only to English, Spanish is one of the most frequently used languages in the Portland community. This fact, coupled with the university's two-year foreign language requirement, makes Spanish instruction at Portland State in extremely high demand. In past years, the university has only had the resources to offer as many as ten sections of the course – at about thirty students per section, only 300 students could potentially be served. However, long enrollment waitlists at the beginning of each term for all of the sections made it apparent that there were still many more students

interested in taking part in the courses. By developing web-based activities that would be graded by the computer, the time instructors would normally have to use for grading assignments would be significantly reduced, thus decreasing their workload. This reduction in time commitment per section could then result in instructors teaching more than the traditional number of sections.

The idea of using technology to reduce the work load of the instructors, thus providing the resources needed to increase enrollment, was not initially well received by all of the members of the Department of Foreign Languages and Literature. Training in traditional delivery methods and extensive experience in language teaching caused many to be skeptical of the effectiveness of the redesigned courses. In addition to analyzing the cost-savings of this new delivery style, the Pew grant team would also have to prove to their colleagues that the instruction was as beneficial to the students as traditional methods. The two-year project is now in its seventeenth month and data is being collected to confirm the quality of the redesigned courses.

In addition to ascertaining whether or not the redesigned courses were providing quality learning experiences for the student population as a whole, the question of how individual learners are affected by this alternate design was also a matter needing investigation. Of particular interest to this researcher was the relationship between learning style preferences and student success in this computer-

enhanced learning environment, specifically whether or not students with certain learning style preferences were better served by the inclusion of the web-based tools.

Author's Involvement

Personal involvement in this course redesign project made the outcomes of this research of particular interest to the author. As a graduate research assistant in the Instruction and Research Services department at Portland State University, the author has been working on this grant project for the past two years as the primary instructional designer. This position included duties such as providing training and technical support to the instructors and other grant team members, as well as creating and developing the online environment used for this course offering. This project has provided the author with the opportunity to learn an immense amount about the field of CALL, and also the chance to teach others about it benefits. Although this experience has also given the author to witness the challenges of this type of learning environment, it has also reinforced the belief that it can be truly beneficial to many types of learners. This familiarity with both sides of the issue makes the investigation of which aspects make CALL more or less valuable to learners of such importance to the researcher.

Summary

Technological advances are swiftly reshaping our traditional ideas of the ideal classroom environment. Multimedia tools allow students to experience lessons in a way unlike they ever have before. However, while these tools appear to be adding to students' educational experiences, research that supports this assumption is still inadequate. This study aims to contribute knowledge to the field of CALL that will help future educators better understand how to create a valuable learning environment for all types of students.

CHAPTER II
LITERATURE REVIEW

Introduction

Over the past twenty years, educators have become increasingly aware of the role student learning styles play in the success of their classrooms. There are currently a plethora of theories about how to define learning style and, once defined, how we might be able to effectively identify the styles of our learners. However, while much of this type of research has been conducted in traditional learning environments, studies that examine non-traditional, technology-enhanced classrooms are scarse. The following chapter will provide a brief overview of learning style theory, as well as outline research in the field of computer-assisted instruction (and specifically CALL) that has added knowledge to the field about the relationship between student learning style and classroom success.

Learning Style Theory

The notion that individuals have different ways of processing information is not new to the field of education – educators have long recognized that students have distinct styles of learning. While some researchers have identified the early days of learning style research with the work of Carl Jung on psychological types (Claxton, 1987; Lewis, 1991; Snyder, 2000), others acknowledge learning style studies as early

as the nineteenth century (Soo in Egbert & Hanson-Smith, 1999). Although much of this early research was conducted within the field of psychology, today's educators are beginning to realize that learning style theory may also help us to better understand learners' differences and how we may use this knowledge to enhance instructional effectiveness.

The definition of learning styles may differ greatly depending on where the term is being used. For the purposes of this research, I will follow a definition put forth by Reid (1998) which describes learning styles as "internally based characteristics, often not perceived or consciously used by learners, for the intake and comprehension of new information" (p. ix). This definition implies that an individual's learning style is not deliberately chosen by the individual, but is instead an inherent tendency or preference that is intrinsically used for processing new information. The idea of learning styles is different from that of learning strategies in that strategies describe conscious decisions that are made by individuals about how to best process information. To further clarify, Oxford describes learning strategies as "actions taken by second and foreign language learners to control and improve their own learning." (Oxford, 1990, p. ix). Strategies, then, might include behaviors like taking notes, creating mnemonic devices or grouping information in ways that are meaningful to the learner (Chamot, Barnhardt, El-Dinary & Robbins, 1999). This

study deals specifically with the investigation of student learning styles and does not take into consideration individual learning strategies.

Learning style models being used in educational research today may boast anywhere from two to seven or more basic approaches to learning (Lemire, 2002; Reid, 1998; Reiff, 1992; Schmeck, 1998; Sims & Sims, 1995). While each of these theories offers a unique perspective on the issue of learning styles, most can be categorized into one of the following three groups – cognitive, affective and physiological (Cornett, 1983; Reiff, 1992). Reiff (1992) identifies cognitive style as "the way a person perceives, remembers, thinks, and solves problems" (p. 8). This category of learning style theories looks at the way learning impacts thinking processes (Cornett, 1983). Affective style looks at the roles personality and emotion may play in one's learning process; this style may also address issues of responsibility and motivation for one's learning (Cornett, 1983; Reiff, 1992). Physiological style relates to the more environmental aspects of learning, like room lighting, temperature and time of day (Cornett, 1983; Reiff, 1992).

While all of the learning style models that exist offer some important information about how students learn, the focus of this study will be on the cognitive styles of the learners involved. In courses that use online tools, physiological style is difficult to control and measure because the environment students may choose to work in could vary from day to day. The relationship between a student's affective

style and their success in the online environment is an area of great interest to the field, however, due to the fact that studies in this area are still relatively new, measuring this variable appear to be challenging. The cognitive learning style has received much attention in the field of education and, as such, tools for measuring this characteristic are both plentiful and often well-tested. For these reasons, it was decided that this study would concentrate on the relationship between cognitive style and student success. From this point in the paper on, these cognitive styles will simply be referred to as *learning styles* or *learning style preferences*.

One of the specific models within this general cognitive category looks at learning modalities to categorize how students learn. Reiff describes learning modalities as "the sensory channels or pathways through which individuals give, receive, and store information" (1992, p. 17). Some modalities commonly referred to in the field of education research are *visual* (learning by seeing), *auditory* (learning by hearing), *kinesthetic* (learning by moving) and *tactile* (learning by feeling or touching). Often, the kinesthetic and tactile modalities are grouped together or used interchangeably (Reiff, 1992), possibly because touching involves some amount of movement. While individuals learn by using all of these modalities to some extent, most have strengths in one or two particular modalities. These preferences are not resolute – individuals can learn how to make better use of modalities they are not

particularly comfortable with, and in some cases, these preferences simply change over time (Brown, 1994, Reid, 1998, Schmeck, 1988).

Many learning style surveys exist to determine which of these basic modalities students prefer to use in the learning process, each with their own strengths and weaknesses, making the selection of an instrument challenging. However, due to the technological variable present in this study, the most appropriate choice for a learning style inventory seemed one that had been designed for use with students in a technology-enhanced learning environment. One such survey was developed by Dr. Marguerita McVay to help students in an online degree program identify their own mental models. Her research suggests that if students have a better understanding of how they prefer to learn, they will be more able to adapt to situations wherein they have to use other less comfortable learning techniques, leading to greater academic success (McVay, 2000a). Others in the field of language teaching have also reached similar conclusions, claiming that making students aware of their less preferred styles and giving them the tools to strengthen them is in the best interest of the student (Brown, 1994; Felder, 1995).

The fact that classrooms contain a diversity of learning styles is an accepted fact in the field of education. Many educators believe that by simply presenting a variety of learning activities, they will address the learning styles of most, if not all, of their students (Diaz & Cartnal, 1999). However, research has shown that the design

of instructional materials is best approached with a conscious knowledge of all the styles that may be present in any given classroom (Grasha & Yangarber-Hicks, 2000; Lynch, 2002). Creating instruction that takes into consideration all of the possible learning styles within one classroom can, however, be extremely difficult. It is for this reason that educators are beginning to look to computers to help them create learning environments that are beneficial to all types of learners.

Computer-Assisted Instruction

As the student population in the U.S. and around the world becomes increasingly diverse, educators are looking for new and more effective ways to facilitate learning. Computer-assisted instruction (CAI) is one area that has found favor with many of these instructors; and studies conducted in a variety of subject areas seem to be showing that a CAI approach does indeed improve overall student achievement (Ester, 1994; Kulik, Kulik & Cohen, 1980; Price, 1989). Bates (1995) specifically identifies some of the instructional benefits of computer-based learning tools to be the capacity to allow learners to select material appropriate to their learning needs and the ability to provide learning environments that are customized to a specific situation (p. 191).

However, while many have looked at the effectiveness of CAI as an instructional method, some suggest that "research is just beginning to catch up with

the concept of studying the relationships between CAI and learning preferences" (Geisert, Dunn & Sinatra, 1990, p. 298). Identifying how differing learning characteristics affect achievement in the technology-enhanced learning environment appears to be a key issue for many educators. Before investing the time and energy in employing these methods in their own classrooms, educators want some assurance that CAI is going to be effective for the vast majority of their students.

Some researchers have already recognized this need and have designed studies that try to identify a relationship (if any) between learning style and student achievement. One such study, conducted by researchers at the University of Illinois at Urbana-Champaign, attempted to find a correlation between student learning styles and delivery method in a graduate level instructional design course (Aragon, Johnson & Shaik, 2000). The main objectives of this research were to determine if the learning style preferences of students would affect enrollment in an online versus face-to-face course, and if learning style preferences would affect student success in each of the environments. Based on the data gathered, the researchers concluded that although there were apparent learning style differences within both of the two treatment groups, these differences did not significantly affect student outcomes. In their opinion, these results support the idea that all learners have the potential to be successful with either delivery method.

On the other hand, another researcher used an experimental approach to test his hypothesis that learning style preference would not affect how well a student learns with either lecture-based or computer-assisted instruction (Ester, 1994). To investigate this, he randomly assigned undergraduate students in the music department at a large, Midwestern university to two different choral ensemble classes, each of which represented one of the delivery methods to be studied (i.e., computer-assisted and lecture-based). Based on the distinction between concrete and abstract learners, the author found that while learning style did not seem to affect success within a group, concrete learners did significantly better in CAI and abstract learners tended to achieve more success in the lecture-based classrooms. In looking at the outcome of his study, Ester concluded that some of the students were able to learn more independently via the online delivery method, instructors would have more time to provide help to struggling students (Ester, 1994). Interestingly, however, this research does not support the majority of the work done in the field of CAI. The overwhelming trend actually shows that abstract learners, who are often also visual learners, are frequently the most successful students in courses that have an online component (Lynch, 2002; Smith & Woody, 2000).

A later study looked at the relationship between learning styles and student performance in an online Research Methods class (Loomis, 2000). Unlike most of the previous research, this study looked both at learning styles as well as students'

overall attitudes toward learning and their relationship to student performance. After synthesizing both quantitative and qualitative data gathered from student evaluations and performance scores, Loomis concluded that "students' learning and studying styles played a crucial role in their success in [the] course; perhaps even a bigger role than their learning styles play in the traditional classroom" (Loomis, 2000). He seems to suggest that the interaction between content delivery and learning style greatly impacts student success. Loomis also notes his belief that as students begin to become more aware of their learning styles and how content delivery affects their success, they may be better able to choose the types of courses in which they participate.

Despite the fact that research in this area is becoming increasingly common, there still seems to be as many conclusions about the relationship between student learning style preference and success in technology-enhanced courses as there have been studies. While this fact may be partially due to the lack of consensus about what exactly a learning style is, it is also apparent that more research needs to be conducted in this area.

Computer-Assisted Language Learning

The studies cited in the previous section focus on how technology impacts learning in a variety of different content courses, thus helping us to better understand

the role technology may have in a typical educational setting. However, researchers are also looking at the use of technology specifically in relation to language learning. While this type of research is only a few decades old, it is becoming increasingly popular in the field of second language acquisition (Chapelle, 2001).

Much of the research currently published in the area of CAI as it relates to the language learning classroom is geared towards helping to identify the role that CALL may play in future educational settings and guiding educators through the development of online materials that fully utilize the resources that are becoming available to them (Harrell Jr., 1999; Warschauer, 1997). This type of research helps educators to understand that, while technology can help to greatly enhance the learning experience in a language classroom, how the technology is used and which aspects of the learning process are incorporated with the use of these tools will ultimately define the instructional success (Oxford, Rivera-Castillo, Feyten & Nutta, 1998). However, while this kind of research gives us an overall view of how technology can impact the classroom, it does not help us understand how individual learners may be affected by this alternative instructional format. Nevertheless, although specific research in this area is indeed lacking, the few studies that do exist (presented in this section) along with research in other content areas may help us to better understand how technology can enhance instruction in all kinds of educational settings, including the language classroom.

Though research that identifies the relationship between individual learner characteristics and success in the language learning classroom is scarce, many language educators believe that CALL can indeed offer a more beneficial learning environment to students of all learning styles. The multi-sensory capabilities and flexible format of such a language learning experience many believe to be ideal for almost any language learner. In fact, Soo (in Egbert & Hanson-Smith, 1999) points out that "a single multimedia program can cater to many learning styles simultaneously because the software teaches in auditory, visual, and kinesthetic media" (p. 299), thus illustrating that the inherent nature of the CALL environment dictates its ability to serve students with any kind of preferred learning style.

Because of its relative youth and the fact that the support of CALL efforts is split between language educators, research is rather sparse. Most of the research that has been conducted in the field focuses on a specific language skill, like reading or listening comprehension, or on the motivational factors affecting student success in the CALL environment (Tchaïcha in Debski & Levy, 1999). Research that looks at learner characteristics and their relationship to course success (like the research that is being conducted in other areas) exists, but is still not prevalent in the field of second language acquisition.

One CALL research project supports the hypothesis that the instructional method used to teach language can greatly affect student outcomes (Soo & Ngeow,

1998). In an attempt to find ways to better the EFL programs (specifically TOEFL preparation courses) currently provided in some Asian countries, Soo and Ngeow implemented the MCALL (multimedia computer assisted language learning) Project to determine if MCALL (which provided students with no direct teacher contact) could be used to prepare students for the International TOEFL as effectively as a teacher-taught class. Their goal was to create a comparable educational experience while also increasing the speed at which students were able to learn the materials and reducing the costs of the instruction. They were also very interested in factors other than the delivery method that might lead to student success (measured by the TOEFL). While the many factors they analyzed (race, gender, learning style) did not seem to significantly affect achievement, they did find that the instructional method greatly affected student outcomes, showing a 50% improvement in terms of TOEFL scores in the MCALL group over the teacher-taught classes. In addition, the data showed that the MCALL students were able to learn in 31% less time and their instruction cost 83% less than that of the other group. Also, the learner-centered environment that MCALL provided caused students to be more motivated toward learning and created a more pedagogically sound learning experience.

practice oral skills than in the traditional classroom model. Considering the focus the department has on communicative competency, most instructors view this as a significant benefit to the new model. Outside of class, students completed one learning module per week that included grammar and vocabulary exercises, as well as activities that reinforced listening, reading, writing and speaking skills. Table 3.1 outlines a typical learning module:

Table 3.1 Outline of Online Learning Modules

Module Element	*Purpose*
Introduction	Introduces general theme of module and identifies specific learning objectives for that module.
Modelos para converser	
Modelo	A model conversation between two or more native speakers is presented that relates to the theme of the module. Both text and audio is provided for practice.
Modelo quiz	This quiz asks multiple choice questions that assess the students' comprehension of the model conversation presented. Also present is easy access to the audio clip, but not the text of the conversation.
Vocabulary quiz	To test knowledge of vocabulary presented in the model conversation, students are asked to complete sentences in the target language by selecting from a short list of words.
Estructuras	
Grammar presentation	Students are provided with an online presentation of a single grammar point. Most learning modules contain 2 – 4 grammar points. The presentation also gives students an opportunity to practice the grammar point with an ungraded, interactive quiz.
Grammar quiz	After reviewing the presentation and doing the practice activity, students are required to complete a graded quiz that assesses their comprehension of the grammar point. This quiz usually mirrors the practice activity.

Module Element	*Purpose*
Programas de radio	
Listening comprehension quiz	Students are given a short audio clip of a radio program taken off the air in a Spanish-speaking country. After listening to the native speech sample, they are asked a number of multiple choice questions about what was presented in the clip.
Vamos a leer	
Reading comprehension quiz	A short text about some element of Spanish-speaking culture is presented to students and they are asked to answer questions (in short answer format) about what they have read.
Terminado	
Checklist	Students are shown a list of things that they should be able to do prior to completing the module, as well as skills that they should have from previous modules. This information is not retrieved by instructors, but merely for use by the students to assess their own learning.

Participants

A total of 77 students served as the participants for this research, all of whom were in enrolled in one of the reduced seat time sections of First-Year Spanish at Portland State University during the fall term of 2002. This group of participants proved to be rather homogenous, most being white, undergraduate females between the ages of 18 and 29. Table 3.2 includes more detailed demographic data:

Table 3.2 - Demographic Data for Participants

		Total #	Percentage
Gender	Male	20	26%
	Female	57	74%
		Total #	**Percentage**
Age	Under 18	1	1%
	18 – 29	65	84%
	30 – 39	9	12%
	50 – 59	1	1%
	60 – 69	1	1%
Ethnicity	Asian/Pacific Islander	4	5%
	Black African American	2	3%
	Hispanic	2	3%
	Middle Eastern	1	1%
	White	59	77%
Class Standing	Freshman	20	26%
	Sophomore	25	32%
	Junior	25	32%
	Senior	2	3%
	Post-baccalaureate	2	3%
	Graduate	3	4%

Data collected in previous terms and anecdotal evidence from instructors in the foreign language department seems to suggest that this is a typical student body profile for these introductory Spanish courses.