An investigation into the relationship between academic risk taking and chemistry laboratory anxiety in Turkey

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This study evaluates the relationship between academic risk taking and chemistry laboratory anxiety using a relational scanning model. The research sample consisted of 127 undergraduate students (sophomores, juniors and seniors) in the Chemistry Teaching Department at Dicle University. This research was done in the spring semester of the 2012 to 2013 academic year. The Chemistry Laboratory Anxiety Scale, developed by Bowen (1999) and adapted into Turkish by Azizoglu and Uzuntiryaki (2006), was used to measure students’ levels of chemistry laboratory anxiety. The Scale of Academic Risk Taking, developed by Clifford (1991) and adapted into Turkish by Korkmaz (2002), was used to measure students’ levels of academic risk taking. The relationship between chemistry laboratory anxiety and academic risk taking was examined using a structural regression model. It was found that academic risk taking explained 39% of the total variance in the chemistry laboratory anxiety scores. This study aims to contribute to the chemistry education literature and to guide chemistry teachers.

Key words: Chemistry laboratory anxiety, academic risk taking.

INTRODUCTION

With improvements in the scientific knowledge and technology, there is an increasing need for the kind of scientific literacy that allows people to use their knowledge and talents to solve everyday problems (MEB, 2004; National Research Council, 1996). Physical sciences, and in particular, chemistry courses, have an important role in teaching scientific literacy (Pehlivan and Koseoglu, 2011). Chemistry courses intend to make people aware of their personal and social responsibilities and to inform them about chemistry notions and principles that affect daily life (MEB, 2008). Since chemistry is an experimental field of study (Beach and Stone, 1988; Johnstone and Al-Shuaibi, 2001; Limniou et al., 2007), laboratory activities are highly necessary for chemistry education to achieve its aims (Hofstein and Walberg, 1995; Nakhleh et al., 2002; Reid and Shah, 2007). Laboratory activities enhance students’ scientific endeavors (Shulman and Tamir, 1973) and questioning abilities (Taskin et al., 2002), and allow them to experiment with and observe the course topic and related...
concepts (Icelli et al., 2007, Yalvac and Sungur, 2000; Yilmaz and Morgil, 1999). Experimentation and observation enable students to actively participate in solving problems, making research hypotheses, collecting, analyzing and interpreting data, and finally, making suggestions for the solution of the problems (Bennett and O’Neale, 1998; Hofstein et al., 2001; Hofstein and Walberg, 1995; Kirschner and Meester, 1988; Martin-Hansen, 2002). These are the benefits of the laboratory activities:

- They concretize abstract chemistry concepts (Demircioglu and Demircioglu, 2005; Harman, 2012), and contribute to an effective learning (Turan, 2005; Yilmaz, 2005).
- They help create a constructivist learning atmosphere (Gunstone, 1991; Hofstein et al., 2001; Martin-Hansen, 2002) and support meaningful learning experiences (Can, 2012; Ekici, 2009; Hofstein et al., 2001; Tobin, 1990) by allowing students to apply their theoretical knowledge (Aydin, 2009; Jall, 2006; Reid and Shah, 2007).
- They help students to improve knowledge retention (Ayas et al., 2002; Tetzcan and Gunay, 2003) and understand the nature of science (Hofstein and Lunetta, 1982; Hofstein et al., 2001).
- They improve students’ time management skills (Buntine et al., 2007), of problem solving (Johnstone and Al-Shuaibi, 2001; Ulucinar et al., 2004), decision making, critical thinking (Cepni et al., 1995; Serin, 2001), creative thinking (Turan, 2005) and knowledge of scientific processes (Harman, 2012).
- The laboratory offers a less formal atmosphere than the classroom and facilitates teacher-student interactions (Lazarowitz, 1991; Tobin, 1990). It supports social interaction (Lazarowitz and Tamir, 1994) and creates an effective learning atmosphere that allows students to collaborate with each other (Buntine et al., 2007; Lazarowitz, 1991; Hofstein et al., 2001; Tobin, 1990).

Given the advantages of the laboratory work, the fact that laboratory work is a fundamental part of chemistry education is obvious (Bodner et al., 1998; Dogan et al., 2003). To get the most use out of laboratory activities, an effective engagement with the laboratory work is necessary (Deters, 2005; Nakipoglu, 1994). Students’ attitudes towards laboratory work (Azizoglu and Uzuntiryaki, 2006) and their affective characteristics, such as beliefs about self-sufficiency, have a deep impact on the effectiveness of laboratory work (Bowen, 1999). Laboratory anxiety is one of the affective variables in students’ academic achievement (Azizoglu and Uzuntiryaki, 2006; Eddy, 2000; Kaya and Cetin, 2012; Wynstra and Cummings, 1993). To explain students’ attitudes towards laboratory activities, it is not sufficient to consider their levels of anxiety about physics, chemistry and biology classes. Laboratory environments have variables that differ from those of the classroom and can cause different anxieties (Azizoglu and Uzuntiryaki, 2006). Thus, laboratory anxiety needs to be analyzed separately, and Bowen (1999) developed the concept of laboratory anxiety to do so.

Laboratory anxiety causes students to feel stressful and uncomfortable while they are working in the laboratory (Eddy, 2000). There are five categories that help explain laboratory anxiety: i) working with chemicals, ii) using laboratory equipment and conducting experiments, iii) data collection, iv) collaboration with other students, v) time management in the laboratory (Bowen, 1999). According to Bowen, considering students’ scale scores for each category will increase the effectiveness of the laboratory work. For instance, if a student is anxious about the time-management, that student needs support in managing time, rather than focusing on other anxiety categories.

Another affective characteristic which influences students’ laboratory anxiety and academic achievement, is academic risk taking behavior (Ozyilmaz, 2008). Academic risk-taking behaviors signify students’ willingness or unwillingness to overcome the difficulties they face in the learning environment (Korkmaz, 2002). They have a four-dimensional structure including recovery from academic failure and the tendency to be effective (AFTE) (Korkmaz, 2002, Tay et al., 2009); the tendency to prefer difficult tasks (TPDT); negative attitudes after academic failure (NAAF) and the tendency to avoid doing homework (TAH) (Korkmaz, 2002). If students have low NAAF and TAH, but high AFTE and TPDT, it can be said that they have the willingness to take academic risks. Students with high levels of academic risk taking:

- are eager to participate in the course activities, even if there is a possibility of failure (Strum, 1971)
- enjoy learning
- have high levels of motivation (Clifford, 1998; House, 2002), problem solving skills and low levels of learned helplessness (Tay et al., 2009)
- resist the difficulties they face in the learning process (Clifford, 1998)
- have no difficulty realizing their potentials (Esen, 2005; Neihart, 2010).

The literature suggests that students’ laboratory anxieties and laboratory activities affect each other (Eddy, 2000; Kaya and Cetin, 2012; Wynstra and Cummings, 1993; Buntine et al., 2007). The willingness to take academic risks has been found to be advantageous for an academic achievement (Clifford, 1991; Clifford and Chou, 1991; House, 2002). The literature also provides evidence for the relation between the high levels of anxiety and risk avoiding behaviors (Lerner and Keltner, 2000; Maner and Schmidt, 2006; Maner et al., 2007). Therefore, it is supposed that chemistry laboratory anxiety derives from academic risk taking behaviors. However, there is no literature to be found on the relation between chemistry laboratory anxiety and academic risk.
taking behaviors. This study evaluates the relation between these two variables. Given that laboratory activities are fundamental in the study of chemistry, the role of laboratory activities in effective chemistry teaching is obvious, so this study aims to contribute to the relevant literature and to guide chemistry teachers.

**METHOD**

A relational scanning model was used in this study. This model determines the level of change that occurs simultaneously between two or more variables (Karasar, 2009).

**Research sample:** The research sample consisted of 127 undergraduate students in the Chemistry Teaching Department at Dicle University. It was done in the spring semester of the 2011 to 2012 academic year. Of the 127 participant students, there were 68 women (53.5%) and 59 men (46.5%). Since freshmen rarely work in the laboratory, they were not included in the sample. There were 34 sophomores (26.7%), 20 juniors (15.7%), 28 seniors (22.1%) and 45 students in their fifth year (35.4).

**Data collection tools:** The Chemistry Laboratory Anxiety Scale (CLAS) and the Academic Risk Taking Scale (ARTS) were used as data collection tools:

**Chemistry Laboratory Anxiety Scale (CLAS):** CLAS was developed by Bowen (1999) and adapted into Turkish by Azizoglu and Uzuntiryaki (2006). This is a five point likert type scale that contains 20 items. Fifteen items indicate laboratory anxiety and 5 items do not. They are scored reversely. The original form of CLAS had five dimensions. The first dimension regarded the use of the chemicals. The second was concerned with the use of the laboratory equipment and doing experiments. The third dimension was data collection, and the fourth was collaboration with other students. Finally, the fifth dimension was devoted to time management in the laboratory. Unlike the original scale, the Turkish version of the scale has four dimensions that explain 66.71% of the total variance. The first 6-item dimension was “the use of laboratory equipment and chemicals (ULEC).” It explained 39% of the total variance (example item: “I have no trouble using the laboratory equipment”). The second 4-item dimension was “collaboration with other students (COS).” It explained 11% of the total variance (example item: “I find it stressful to work with other students in the chemistry exam”). The third 6-item dimension was “data collection (DC).” It explained 9.78% of the total variance (example item: “When I study in the chemistry laboratory, I worry about losing the data I need”). The forth 6-item scale was “time management in the laboratory (TML).” It explained 6.90% of the total variance (example item: “I worry whether or not I will complete my laboratory work on time”). The scores for each sub-dimension in the CLAS can be used to get a total score for laboratory anxiety. In a study done by Azizoglu and Uzuntiryaki (2006), the reliability coefficient of the Turkish version of the CLAS was calculated by the internal consistency method. The Cronbach alpha reliability coefficient value was 88 for the ULEC, 87 for the COS, 86 for the DC and, 87 for the TML. The reliability coefficient value for CLAS was 90 for the entire scale, 78 for the ULEC, 78 for the COS, 77 for the DC and, 70 for the TML Table 1. Scales with reliability coefficients above, 70 are considered reliable (Buyukozturk, 2010; Nunnaly and Bernstein, 1994; Pallant, 2005; Tezbasaran, 1997). Thus, the CLAS and its dimensions are reliable.

**Academic Risk Taking Scale (ARTS):** The ARTS was developed by Clifford (1991) to assess students’ courage and willingness to overcome the difficulties they face in the learning process. It is a 36-item five point likert scale. In its original form, there are three sub-dimensions, namely NAAF, TPDT and AFTE. The scale was adapted into Turkish by Korkmaz (2002). The Turkish version includes, in addition to the three dimensions, a fourth dimension called TAH. The dimension of NAAF in the Turkish version has 12 items (example item: “When I make study mistakes, I feel very discouraged”). There are 10 items in the TPDT dimension (example item: “I enjoy difficult homework more than simple homework”). There are 11 items in the AFTE dimension (example item: “If I get a low grade, I focus on my mistakes and restudy the material on the exam that I failed to learn”). In the TAH dimension of the scale, there are 3 items (example item: “If I have difficult homework, I try to avoid doing it”). The scores for each sub-scale in the ARTS can be used to get a total score for academic risk taking. Korkmaz’s study (2002) found the scale’s reliability for internal consistency to be 0.89 when it was used with university students, and 0.90 when it was used with high school students. The reliability coefficient of the entire ARTS was 0.85. The internal consistency coefficient Table 2 was 0.77 for the NAAF, 0.67 for the TPDT, 0.70 for the AFTE and, 61 for the TAH. Scales with reliability coefficients above 0.70 are considered reliable (Buyukozturk, 2010; Nunnaly and Bernstein, 1994; Pallant, 2005; Tezbasaran, 1997). The academic risk taking scale and the sub-scales, excluding TPDT and TAH, satisfied this criteria. It also needs to be considered that for scales with a low number of items values of 0.60 and above are sufficient for reliability (Sipahi, Yurtkoru and Cinko, 2010). Thus, the reliability coefficients for the sub-scales TPDT and TAH satisfy the reliability criteria.

**Application:** Data was collected in the spring semester of the 2012 to 2013 academic year. The scale was given to the students when they were in the laboratory. The physical presence of the researcher in the laboratory was a great concern. The research participants were informed about the aim of the study, and it was emphasized that the collected data would not be shared with any institution or individual. Since the research complied with the voluntariness principle, they were also informed that their participation was not required. The researchers reminded the participants that honest answers were crucial for getting valid and reliable results. In the first section of the data collection tool, there were questions about demographic data including gender, age, department and years of university education. In order to match the participants’ results on the chemistry laboratory anxiety scale with their results on the academic risk taking scale, the two scales were administered simultaneously. Another way could be to record students’ names and give them, the scales at different times. However, taking the participants’ names might keep them from giving honest answers. Thus the simultaneous option was preferable. Most participants completed the data collection tools in 25 to 30 min.

**Data analysis:** This study evaluated the relation between academic risk taking and the chemistry laboratory anxiety using the Pearson Product-Moment Correlation Coefficient. The structural regression model was used to determine the effect of academic risk taking on chemistry laboratory anxiety. In the structural regression model, a variety of fit indices are empTAHd in order to decide whether the collected data confirm the model assumed by the researcher. This study’s model for explaining the relation between academic risk taking and chemistry laboratory anxiety was proven to be sufficient by a broad range of fit indices including Chi-Square Goodness, Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index, Comparative Fit Index (CFI), Normed Fit Index (NFI), Non-Formed Fit Index (NNFI), Relative Fit Index (RFI), Incremental Fit Index (IFI), Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), Parsimony Normed Fit Index (PNFI) and Parsimony Goodness of Fit Index (PGFI).
Table 1. The number of the items in the class, example items and their internal consistency coefficients.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>The number of the Items</th>
<th>Example Item</th>
<th>Internal consistency coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULEC</td>
<td>6</td>
<td>I have no trouble using the laboratory equipment</td>
<td>.78</td>
</tr>
<tr>
<td>COS</td>
<td>4</td>
<td>I find it stressful to work with other students in the chemistry exam</td>
<td>.78</td>
</tr>
<tr>
<td>DC</td>
<td>6</td>
<td>When I study in the chemistry laboratory, I worry about losing the data I needed</td>
<td>.77</td>
</tr>
<tr>
<td>TML</td>
<td>4</td>
<td>I worry about whether or not I will complete my laboratory work in time</td>
<td>.70</td>
</tr>
</tbody>
</table>

Table 2. The number of the Items in the ARTS, example Items and their internal consistency coefficients.

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>The number of the Items</th>
<th>Example Item</th>
<th>Internal consistency coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAAF</td>
<td>12</td>
<td>When I make mistakes, I feel very discouraged</td>
<td>.77</td>
</tr>
<tr>
<td>TPDT</td>
<td>10</td>
<td>I enjoy difficult homework more than simple homework</td>
<td>.67</td>
</tr>
<tr>
<td>AFTE</td>
<td>11</td>
<td>If I get a low grade, I focus on my mistakes and re-study the material on the exam I failed to learn</td>
<td>.70</td>
</tr>
<tr>
<td>TAH</td>
<td>3</td>
<td>If I have a difficult homework, I try to avoid doing it</td>
<td>.61</td>
</tr>
</tbody>
</table>

Table 3. Descriptive statistics and the correlation coefficients between the variables.

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULEC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.44**</td>
</tr>
<tr>
<td>COS</td>
<td>.44**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC</td>
<td>.68</td>
<td>.46*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TML</td>
<td>.57</td>
<td>.49*</td>
<td>.67*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAAF</td>
<td>.46</td>
<td>.24*</td>
<td>.48*</td>
<td>.46*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TPDT</td>
<td>-.34*</td>
<td>-.26*</td>
<td>-.37*</td>
<td>-.42*</td>
<td>-.41*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AFTE</td>
<td>-.29*</td>
<td>-.19*</td>
<td>-.34*</td>
<td>-.38*</td>
<td>-.52*</td>
<td>.61*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAH</td>
<td>.28*</td>
<td>.19*</td>
<td>.33*</td>
<td>.28*</td>
<td>.46*</td>
<td>-.57*</td>
<td>-.40*</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>2,37</td>
<td>1,97</td>
<td>2,19</td>
<td>2,30</td>
<td>2,86</td>
<td>3,44</td>
<td>3,66</td>
<td>2,73</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>.80</td>
<td>.87</td>
<td>.74</td>
<td>.83</td>
<td>.64</td>
<td>.58</td>
<td>.57</td>
<td>.73</td>
</tr>
</tbody>
</table>

FINDINGS

This section presents descriptive statistics for the correlations between the variables in the data set of the chemistry laboratory anxiety (ULEC, COS, DC and TML) and the variables in the data set of academic risk taking scale (NAAF, TPDT, AFTE and TAH). Then it presents the structural regression model to explain chemistry laboratory anxiety with the levels of academic risk taking.

Descriptive statistics and the correlation coefficients between the observed variables

Table 3 shows the mean and the standard deviation scores for the research variables, and the correlation coefficients between them. Table 3 shows that the relation between academic risk taking and the chemistry laboratory anxiety was significant.

Structural regression model: This study is designed to assess the hypothesis that academic risk taking is a predictor variable in the chemistry laboratory anxiety. Academic risk taking is an implicit variable measured on the scales NAAF, TPDT, AFTE and TAH; and the chemistry laboratory anxiety is a variable measured on the scales NAAF, TPDT, AFTE and TAH. According to the Kolmogorov-Smirnov test, the variables had a normal distribution. So the hypothesis was tested by the
Table 4. The acceptable and perfect goodness of fit index values and the goodness of fit indices from CFA.

<table>
<thead>
<tr>
<th>Fit indices observed</th>
<th>Perfect fit indices</th>
<th>Acceptable fit indices</th>
<th>Fit indices obtained</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \chi^2/ \text{sd} )</td>
<td>0 ( \leq \chi^2/ \text{sd} \leq 2 )</td>
<td>2 ( \leq \chi^2/ \text{sd} \leq 3 )</td>
<td>1.59</td>
<td>Perfect Fit</td>
</tr>
<tr>
<td>GFI</td>
<td>0.95 ( \leq \text{GFI} \leq 1.00 )</td>
<td>0.90 ( \leq \text{GFI} \leq 0.95 )</td>
<td>0.94</td>
<td>Acceptable Fit</td>
</tr>
<tr>
<td>AGFI</td>
<td>0.90 ( \leq \text{AGFI} \leq 1.00 )</td>
<td>0.85 ( \leq \text{AGFI} \leq 0.90 )</td>
<td>0.89</td>
<td>Acceptable Fit</td>
</tr>
<tr>
<td>CFI</td>
<td>0.95 ( \leq \text{CFI} \leq 1.00 )</td>
<td>0.90 ( \leq \text{CFI} \leq 0.95 )</td>
<td>0.98</td>
<td>Perfect Fit</td>
</tr>
<tr>
<td>NFI</td>
<td>0.95 ( \leq \text{NFI} \leq 1.00 )</td>
<td>0.90 ( \leq \text{NFI} \leq 0.95 )</td>
<td>0.95</td>
<td>Perfect Fit</td>
</tr>
<tr>
<td>NNFI</td>
<td>0.95 ( \leq \text{NNFI} \leq 1.00 )</td>
<td>0.90 ( \leq \text{NNFI} \leq 0.95 )</td>
<td>0.97</td>
<td>Perfect Fit</td>
</tr>
<tr>
<td>IFI</td>
<td>0.95 ( \leq \text{IFI} \leq 1.00 )</td>
<td>0.90 ( \leq \text{IFI} \leq 0.95 )</td>
<td>0.98</td>
<td>Perfect Fit</td>
</tr>
<tr>
<td>RFI</td>
<td>0.95 ( \leq \text{RFI} \leq 1.00 )</td>
<td>0.90 ( \leq \text{RFI} \leq 0.95 )</td>
<td>0.92</td>
<td>Acceptable Fit</td>
</tr>
<tr>
<td>RMSEA</td>
<td>0.00 ( \leq \text{RMSEA} \leq 0.05 )</td>
<td>0.05 ( \leq \text{RMSEA} \leq 0.08 )</td>
<td>0.069</td>
<td>Acceptable Fit</td>
</tr>
<tr>
<td>SRMR</td>
<td>0.00 ( \leq \text{SRMR} \leq 0.05 )</td>
<td>0.05 ( \leq \text{SRMR} \leq 0.10 )</td>
<td>0.053</td>
<td>Acceptable Fit</td>
</tr>
<tr>
<td>PNFI</td>
<td>0.95 ( \leq \text{PNFI} \leq 1.00 )</td>
<td>0.50 ( \leq \text{PNFI} \leq 0.95 )</td>
<td>0.64</td>
<td>Acceptable Fit</td>
</tr>
<tr>
<td>PGFI</td>
<td>0.95 ( \leq \text{PGFI} \leq 1.00 )</td>
<td>0.50 ( \leq \text{PGFI} \leq 0.95 )</td>
<td>0.50</td>
<td>Acceptable Fit</td>
</tr>
</tbody>
</table>

Table 4 shows that the model has perfect and acceptable fits. This means that the variables support the model. Figure 1 shows the results for the structural regression model.

Figure 1. Academic risk-taking and chemistry laboratory anxiety.

Maximum Likelihood method. Table 4 presents the fit indices and the related results.

Academic risk-taking and chemistry laboratory anxiety

As Figure 1 indicates, the implicit variable ARA explains 44% of the variance in the NAAF, 60% of the variance in the TPDT, 54% of the variance in the AFTE and 42% of the variance in the TAH. The implicit variable LE explains 58% of the variance in the ULEC, 32% of the variance in the COS, 73% of the variance in the DC and 62% of the variance in the TML. Finally, it was found that academic risk taking positively predicts chemistry laboratory anxiety \( \beta=0.63, t=5.86 \) and \( p<0.001 \), and that academic risk-taking explained 39% of the total variance in chemistry laboratory anxiety \( R^2=0.39 \). Following the findings of the structural regression model, Figure 2 shows the relationship between the chemistry laboratory anxiety and the academic risk taking.

DISCUSSION

This study explored the relation between academic risk taking and the chemistry laboratory anxiety using a structural regression model. According to the findings of this study, academic risk taking explained 39% of the total variance in the chemistry laboratory anxiety. The findings of the structural regression model indicate that chemistry laboratory anxiety had a positive relationship with TAH and NAAF, and a negative relationship with AFTE and TPDT. Students who had low NAAF and TAH, but high AFTE and TPDT were eager to take academic risks. It thus revealed that students who were not willing to take academic risks had higher levels of chemistry laboratory anxiety. This result is supported by the literature that suggests risk avoiding behavior (Lerner and Keltner, 2000; Maner and Schmidt, 2006; Maner et al.,
Figure 2. The common variance in the chemistry laboratory anxiety and academic risk taking.

2007) causes high levels of anxiety (Savitsky et al., 1998; Sheperd et al., 2005). A study done by Kurbanoglu and Akin (2010) found a significantly negative relationship between chemistry laboratory anxiety and self-sufficient conduct in the laboratory. A study by Wu (2005) also found a significantly positive relationship between self-sufficiency and academic risk taking. Thus, the negative relationship between chemistry laboratory anxiety and academic risk taking is clear. This was also supported by the theoretical arguments for risk taking skills as an effective factor in laboratory work (Buntine et al., 2007).

CONCLUSION AND RECOMMENDATIONS

To reduce students' anxiety about the chemistry laboratory and to improve their risk taking skills, a variety of methods can be used, including the predict-observe-explain method, reflective thinking (Oner, 2013), project-based learning (Ciftci, 2006), case studies (Seckin and Yilmaz, 2014), problem-based learning (Cinar and Ilık, 2007), concept cartoons and analogies (Ozyilmaz, 2008). This study concerns only the relationship between the chemistry laboratory anxiety and academic risk taking. The relationship was found to be significant. Students who were eager to take academic risks had high levels of motivation (Clifford, 1998; House, 2002), good study skills (Ilhan et al., 2013), low levels of learned helplessness (Esen, 2005; Neihart, 2010), academic stress (Ilhan and Cetin, 2013) and fear of criticism (Cetin et al., 2014). These variables are supposed to be in a significant relation with the chemistry laboratory anxiety. Yet, further studies are needed to prove this relation. The literature suggests a negative relationship between laboratory anxiety and both achievement in laboratory work (Kaya and Cetin, 2012) and problem solving skills (Kurbanoglu and Akin, 2010). It also reports a positive relationship between academic risk taking and problem solving skills (Tay et al., 2009). There is a need for further studies which explore in detail the relationships between laboratory anxiety, academic risk-taking, achievement in laboratory work and problem solving skills. These studies can help reveal the variables in the negative relationship between chemistry laboratory anxiety and academic risk taking.

Conflict of Interests

The author has not declared any conflict of interests.

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