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FOREWORD

I am pleased to present to you Volume 20 of the Inquiry Undergraduate Research Journal. Inquiry provides a forum for sharing the research and creative endeavors of undergraduate students and their faculty mentors at the University of Arkansas. The Inquiry Journal was developed by the Teaching Academy of the University of Arkansas and is supported financially and conceptually by the offices of the Provost and the Vice Provost for Research and Economic Development. The Inquiry Undergraduate Research Journal website, online publications, and journal archives are expertly managed by the David W. Mullins Library staff.

Volume 20 of the Inquiry Undergraduate Research Journal features the unique contributions of undergraduate student authors and their faculty mentors. The research and creative endeavors that are published in the Inquiry Undergraduate Research Journal span diverse fields at the University of Arkansas, including but not limited to Biological Sciences; Landscape Architecture; Economics; Mechanical & Electrical Engineering; English; Nursing; International Studies; and Curriculum & Instruction. Turning to the research studies in this issue, Kelsey Ferguson, Economics, used cultural economic value theory to explore the perceived intrinsic value of art for participants in their study. Kenny George, Electrical Engineering, examined the feasibility of a high-frequency transformer for a SST intended to interface a renewable energy source to the electric grid. Danielle Koster, Nursing, examined health care disparities experienced by Alaska Native women victims of sexual violence. Claire Luchkina, International Studies, evaluated the usability and content quality of online resources on the topic of permaculture. Keri Tichenor, Curriculum & Instruction, explored the relationships between characteristics of students with autism and their peer mentors and peer-mediated intervention strategy outcomes.

I would like to extend a special thank you to the many faculty members who volunteer their time and expertise in order to mentor the student authors and the faculty members who provide comprehensive reviews of student manuscripts. While we are unable to publish all of the submitted manuscripts, we also want to thank the students and faculty mentors for their diligent efforts. Additionally, I would like to thank Dean Carolyn Allen, Beth Juhl and Dylan Hurd, David W. Mullins Library, for their efforts in publishing each volume of the Inquiry Undergraduate Research Journal electronically. Please see the next page for a list of faculty and staff who play an integral role in publishing each volume of the Inquiry Undergraduate Research Journal.

We plan to publish Volume 21 of the Inquiry journal in September 2016. I encourage undergraduate students and faculty mentors to consider submitting their manuscript to the Inquiry Undergraduate Research Journal by May 16, 2016 for consideration.

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Published by ScholarWorks@UARK, 2016
Does Context Information Affect Perceptions of the Intrinsic Value of Visual Art?

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Department of Economics

Faculty Mentor: Dr. David E. R. Gay
Department of Economics

Abstract

This study is an application of cultural economic value theory within the context of visual art. Current literature supports an incompatibility between objective, empirical economic research and the subjectivity of artistic expression. While variables affecting the intrinsic value of art are difficult to identify and measure, this study quantified the effect of context information on university students’ perceptions of visual art. For this study, 118 randomly assigned University of Arkansas students viewed four identical works of art and answered identical questions designed to measure perceptions of intrinsic value. Despite a hypothesis that context would positively affect participants’ reports, when significant this variable actually lowered participants’ reported values for every question. Results of this study open the door to further research in cultural economics, integrating empirical methodology into arts programmers’ strategies to reach their millennial audiences.

Introduction

Distinctly different from a hard science, economics is a study of value that measures the more flexible aspects of our existence including: human nature, social institutions, physical environment and the relationship between all three to influence people’s perceptions of value. Since any number and degree of factors influence our perceptions, measuring intrinsic value (the value of something for its own sake) allows economics to explore subjects that do not rely on purely objective experience. – such as the perception of art – to connect the seemingly unconnected.

Often, a complete separation is witnessed between the “economic way of thinking” and “artistic expression”. Economists must create objective models to explain a complex, conceptual world, while at the same time an artist’s work is inherently subjective and cannot meet the requirements of scientific investigation. Quantitative economic analysis requires not only the identification of variables within artistic expression that affect the outcomes of our experience, but also it requires the identification of a tangible, measurable outcome. A captivating study by the RAND Corporation in Santa Monica, California, draws inspiration from art philosopher Susanne Langer in which she describes a work of art as an “objectification of subjective life” and “an outward showing of inward nature” (McCarthy, Ondaatje, Zakaras, & Brooks, 2004, p. 65), supporting that artistic expression is a communicative process in which the artist’s tools - the images and forms that embody his or her vision - express human feeling, and these tools achieve this for our perception through sense or imagination. Acknowledging the plight of quantitative analysis, it offers that this artistic expression:

Fills gaps left by communication based on the natural science model of knowledge that dominates our culture. Rather than describing the world in impersonal, abstract, or mathematical terms, it presents a created reality based on a personal perspective that includes the whole uncensored human being with all its feelings, imaginings, and yearnings. (McCarthy et al., 2004, p. 65)

When exposed to a work of art, the viewer perceives some measure of enjoyment and connection (or not) to the piece – two perceptions of intrinsic value. Widespread use of context information by galleries to enhance viewers’ understanding of artworks is intended to increase their enjoyment and connection – but to what degree does this information influence these viewers?

Method

Research Question

This study quantified the effect of one variable on the perceived intrinsic value of art on its viewers,
primarily investigating the hypothesis of the positive effect of context information on reported level of enjoyment and strength of connection, where:

- $H_0$: Exposure to context information does not significantly affect reported level of enjoyment/strength of connection when viewing visual art
- $H_A$: Exposure to context information significantly affects “ ”

**Survey**

All data for this research study were collected through an online survey. All University of Arkansas students enrolled in honors and non-honors sections of art professor Cindy Wiseman’s Western Art History course comprised the population for study. To incentivize participation, students who completed the survey were eligible to receive 10 bonus points in the course. To limit the potential for order effects, this experiment utilized a between-subject design where participants were randomly assigned to one of two surveys: control or treatment. A total of 118 responses were analyzed, and within this sample 60 participants received the control survey while 58 participants received the treatment survey. For all questions, treatment was chosen as the primary explanatory variable. For both the control and treatment groups, participants taking either survey viewed identical works of art. Participants viewed the following four works: Vincent Van Gogh’s *Café Terrace at Night* (Figure 1), Salvador Dalí’s *The Persistence of Memory* (Figure 2), Jackson Pollock’s *White Light* (Figure 3) and a personal work *Catedral* (Figure 4).

---

*Figure 1. Vincent Van Gogh. Café Terrace at Night. 1888 Oil on canvas. 31.9 x 25.8 inches. Kröller-Müller Museum, Otterlo, The Netherlands.*

*Figure 2. Salvador Dali. The Persistence of Memory. 1931. Oil on canvas. 9.5 x 13 inches. The Museum of Modern Art, New York City, New York.*


*Figure 4: Kelsey Ferguson. Catedral. 2012. Digital photograph. 5 x 7 inches. Personal collection.*
These works were chosen for several reasons. First, all but Catedral are internationally recognized artworks and the artists of these works are considered iconic representatives for their respective modern art movements. Showing three works with a very large chance of recognition to the sample better isolated the effect of context information on relatively unknown work, represented by the personal work Catedral. All works were from the modern art timeline only, controlling for time period. Although it is important to note that while each of the artworks shown were created in separate time periods with distinct styles, for the purposes of this study Café Terrace at Night and Catedral were grouped together as “realistic” artworks while The Persistence of Memory and White Light were grouped together as “abstract” works.

For the purposes of this study, the word realistic describes an artwork in which the objects within the scene are identifiable and retain much of their natural composition. Café Terrace at Night is considered a realistic artwork in this study, but by art history standards it cannot be defined as “realistic” over a more precise definition. It is actually a work from the Post-Impressionist time period and while it does show an identifiable scene, the technique that Van Gogh utilizes captures closer to an impression of this scene than an exact representation. While Catedral manipulates the presentation of objects, the objects themselves still retain their natural composition. The term abstract is used in this study to describe an artwork in which either the natural composition of objects is manipulated enough to warrant a significant change in perspective or the scene is nonobjective. The Persistence of Memory is a Surrealist work, and though the objects within it are indeed identifiable, they are manipulated so that their compositions are significantly altered and abstracted. White Light is nonobjective (Adams, 2010).

Participants in both groups answered four identical demographic questions determining class standing, gender, non-honors or honors enrollment in Western Art History, and whether they had previously visited Crystal Bridges Museum of American Art in Bentonville, AR. The class standing choices (e.g., freshman, sophomore, junior, senior and fifth-year senior +) were coded as (1-5) respectively. For gender, participants identified as male, female or other/decline to state. To isolate the effect of context information, experimental design of the control survey versus the treatment survey manipulated the type and amount of information provided underneath each artwork. Before answering each set of questions, participants in the control group viewed only the work’s title and name of the artist responsible for its creation, while participants in the treatment group viewed not only the work’s title and artist name, but also read between three and four sentences of context information that included: a short description of the formal elements of the work, the historical influence of the time period on the work and a quote from the artist about the creation process for the work.

After viewing each work of art, participants were asked (a) to report their level of enjoyment viewing each, and (b) to note how strongly they felt a connection between the content of the artwork and themselves. The first question, “How much did you enjoy viewing this work?” asked participants to report their level of enjoyment on a (1-7) ascending scale from “I Did Not Enjoy It at All” (coded as “1”) to “I Enjoyed It Very Much” (coded as “7”). The second question, “How strongly do you feel a connection between the content of this work and yourself?” asked participants to report their strength of connection on a (1-7) ascending scale from “Not Strong at All” to “Very Strong”, using an identical coding system.

**Regression**

All data were analyzed using econometric regression analysis. The following regressions outline the models for both reported level of enjoyment and strength of connection:

\[
\text{EnjoyOverall} = \beta_0 + \beta_1 \text{Treatment} + \beta_2 \text{Male} + \beta_3 \text{Class} + \beta_4 \text{Treatment} + \mu
\]

\[
\text{ConnectOverall} = \beta_0 + \beta_1 \text{Treatment} + \beta_2 \text{Male} + \beta_3 \text{Class} + \beta_4 \text{Treatment} + \mu
\]

Where:

- **EnjoyOverall, ConnectOverall** = simple average of each participant’s reported level of enjoyment/ strength of connection for each artwork
- **Treatment** = dummy variable, where receiving context information assigns the numerical value 1 (primary explanatory variable)
- **Male/Honors** = dummy variables, where answering male/honors assigns the numerical value 1
- **Class** = simple average of participants’ class standing
- **\( \mu \)** = error term
In addition, dependent variables for each individual artwork were coded into the dataset, where:

- \( \text{Enjoy1}, \text{Connect1} = \text{Café Terrace at Night} \)
- \( \text{Enjoy2}, \text{Connect2} = \text{The Persistence of Memory} \)
- \( \text{Enjoy3}, \text{Connect3} = \text{White Light} \)
- \( \text{Enjoy4}, \text{Connect4} = \text{Catedral} \)

And dependent variables for combinations of artworks were coded as:

- \( \text{EnjoyNoPollock}, \text{ConnectNoPollock} = \text{simple averages for each work of art EXCEPT White Light} \)
- \( \text{EnjoyRealistic}, \text{ConnectRealistic} = \text{simple averages for Café Terrace at Night and Catedral} \)
- \( \text{EnjoyAbstract}, \text{ConnectAbstract} = \text{simple averages for The Persistence of Memory and White Light} \)

**Results**

**Summary Statistics**

Beginning with the primary dependent variable, reported level of enjoyment, Table 1 below displays the summary statistics for all participants’ survey responses in both the control and treatment group.

<table>
<thead>
<tr>
<th></th>
<th>( \text{Enjoy Overall} )</th>
<th>( \text{Enjoy NoPollock} )</th>
<th>( \text{Enjoy Realistic} )</th>
<th>( \text{Enjoy Abstract} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Mean</td>
<td>4.86</td>
<td>5.29</td>
<td>5.34</td>
<td>4.42</td>
</tr>
<tr>
<td>Standard Error</td>
<td>0.08</td>
<td>0.08</td>
<td>0.83</td>
<td>0.11</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.84</td>
<td>0.82</td>
<td>0.91</td>
<td>1.16</td>
</tr>
<tr>
<td>Sample Variance</td>
<td>0.71</td>
<td>0.68</td>
<td>0.82</td>
<td>1.35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>( \text{Enjoy1} )</th>
<th>( \text{Enjoy2} )</th>
<th>( \text{Enjoy3} )</th>
<th>( \text{Enjoy4} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Mean</td>
<td>5.71</td>
<td>5.19</td>
<td>3.66</td>
<td>4.97</td>
</tr>
<tr>
<td>Standard Error</td>
<td>0.08</td>
<td>0.12</td>
<td>0.17</td>
<td>0.13</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.89</td>
<td>1.33</td>
<td>1.85</td>
<td>1.45</td>
</tr>
<tr>
<td>Sample Variance</td>
<td>0.79</td>
<td>1.78</td>
<td>3.44</td>
<td>2.10</td>
</tr>
</tbody>
</table>

At a score of 4.86, on average participant overall reported enjoyment of the artworks was slightly above neutral, leaning closely toward “I Somewhat Enjoyed It.” The highest mean score (5.71) among the sample indicated enjoyment for Vincent Van Gogh’s Café Terrace at Night, while the lowest mean score (3.66) for the sample identified Jackson Pollock’s White Light. When White Light was removed, indicated by the variable EnjoyNoPollock, mean reported enjoyment scores increased; when The Persistence of Memory was removed as well, indicated by the variable EnjoyRealistic, mean enjoyment scores increased even further. The mean enjoyment score (4.42) for EnjoyAbstract fell almost a full point beneath EnjoyRealistic (5.34). Therefore, on average, data findings suggest that participants reported higher enjoyment from the realistic works than from the abstract works.

Sample variance for overall reported enjoyment was 0.71. On average, participants in the sample were fairly stable in their reported levels of enjoyment for all works. Following the trend for sample mean, sample variance for Café Terrace at Night was also the lowest of the four artworks at 0.79, while sample variance for White Light was highest at 3.44. When White Light was removed, sample variance for EnjoyNoPollock fell from 0.71 to 0.68. This followed the trend for mean enjoyment; however, when The Persistence of Memory was removed, EnjoyRealistic sample variance did not further decrease – in contrast, it increased from 0.68 to 0.82. EnjoyAbstract sample variance fell to 1.35. On average, sample variance was lower for the realistic works than for the abstract works, suggesting that while on average participants enjoyed the realistic works more, they also had more volatile responses to the abstract works. This also suggests that responses for White Light alone were volatile enough to explain the reduction in sample variance when controlled for specifically in EnjoyNoPollock, and for the increase when isolated within EnjoyAbstract. Table 2 displays the summary statistics for all participants’ reported strengths of connection in both control and treatment groups.

On average, sample overall reported connection fell slightly below neutral for all works, leaning toward “Undecided”. Compared to Enjoy data, on average participants reported that overall they enjoyed the artworks more than they felt a connection to them. As with enjoyment, mean reported connection to Vincent Van Gogh’s Café Terrace at Night was the highest of the
Lowest reported connection to the artworks was again for Jackson Pollock’s *White Light*. When *White Light* was removed from connection, indicated by the variable ConnectNoPollock, mean reported connection increased from 3.69 to 3.98. When *The Persistence of Memory* was removed, indicated by the variable ConnectRealistic, mean connection actually decreased slightly from 3.98 to 3.97. Sample mean connection for ConnectAbstract fell still lower at 3.40. In this case, the data suggest that, on average, participants also reported higher connection to the realistic works than to the abstract works. Recalling that this was also observed for reported enjoyment, the sample variance for *Café Terrace at Night* was again the lowest of the four artworks at 2.07. In this case, however, sample variance for *White Light* was not the highest; instead, sample variance for *Catedral* was the highest at 2.86. The removal of *White Light* and *Persistence of Memory* increased sample variance of ConnectRealistic, to 1.70, making sample variance for realistic works higher than that for abstract works at 1.36. Data suggest that, on average, while participants connected more to the realistic works, the responses to *Catedral* were significantly volatile. Table 3 displays the demographic statistics for sample distribution. These provide additional insight for potential policy in the final section of this study.

In terms of demographic composition, participants in the sample identified as 40% male and 60% female. No participants responded as other/decline to state. Sample mean (1.63) for class standing indicated that the majority of participants in the sample were underclassmen. Approximately 22% of the participants in the sample were enrolled in the honors section of Western Art History. Finally, approximately 63% of participants in the sample had visited Crystal Bridges Museum of American Art before taking the survey.

### Regression Analyses

The following tables present the results of regression analysis. For all tables, standard errors are in parentheses and numbers in bold with asterisks indicate significance on either the 10%*, 5%** or 1%*** levels. Regarding the primary research question on reported level of enjoyment, Table 4 presents the results from combining artworks, while Table 5 highlights the results from individual artworks.

The original regression on the primary dependent variable, EnjoyOverall, found no statistical significance for Treatment or any other independent variable. Given that EnjoyOverall was a simple average of the responses from individual artworks, enjoyment of each of the four artworks were then regressed separately.
For *The Persistence of Memory*, regression analyses indicated no statistical significance. For only *Catedral*, Treatment was negatively statistically significant. This indicated that exposure to Treatment would decrease a participant’s reported level of enjoyment. For *Café Terrace at Night, White Light*, and *Catedral*, however, identifying as male resulted in a negative statistical significance. In other words, reported level of enjoyment of all three of these works for male participants was lower than reported level of enjoyment for female participants. For *White Light*, Class was also negatively significant, indicating that for every one unit increase in Class (participants moved up a grade), their reported level of enjoyment of *White Light* would decrease further.

Even though it was only statistically significant for *Catedral*, regression analyses revealed that Treatment had a negative relationship with every artwork except Jackson Pollock’s *White Light*. This prompted the question, “Would eliminating this artwork from the EnjoyOverall variable affect Treatment’s significance?” To test this, the variable EnjoyNoPollock was created and regressed on the same independent variables as before. For EnjoyNoPollock, regression still found no statistical significance for Treatment nor any other variable; however, a reduction in p-value for Treatment suggested the need for more analysis. Upon further investigation, the negative coefficient for Treatment on Salvador Dali’s *The Persistence of Memory* (-0.04) was much smaller than that of *Café Terrace at Night* (-0.62) or *Catedral* (-0.47). On the spectrum of “realistic” to “abstract” artworks, Treatment was negatively significant on the most realistic of all the selection: the personal work *Catedral*. On this same spectrum, *The Persistence of Memory* fell somewhere in the middle between *Café Terrace at Night* and the highly abstract work *White Light*. Given this information, the effect of Treatment on the “real” versus “abstract” paintings of the selection was isolated by creating the variable EnjoyRealistic and EnjoyAbstract. EnjoyRealistic became the simple average of all participants’ reported levels of enjoyment for *Café Terrace at Night* and *Catedral*, while EnjoyAbstract became the simple average of all participants’ reported levels of enjoyment for *The Persistence of Memory* and *White Light*.

Regression results regarding the dependent variable Connect tell an equally interesting story. Table 6 and Table 7 present the results of all regression models. Table 6 highlights the results from variables combining artworks, while Table 7 illustrates the results from the variables of individual artworks.

<table>
<thead>
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<th>Table 4 (N=118)</th>
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<th>Enjoy</th>
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<td>Abstract</td>
<td>Realistic</td>
<td>NoPollock</td>
<td>Overall</td>
</tr>
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<td>Treatment</td>
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<td>-0.26</td>
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<td>-0.12</td>
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<td>(0.16)</td>
<td>(0.16)</td>
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<td>-0.41**</td>
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*p<.10, **p<.05, ***p<.01

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<td>1</td>
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<tr>
<td>Treatment</td>
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*p<.10, **p<.05, ***p<.01

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<td>(0.13)</td>
<td>(0.12)</td>
<td>(0.11)</td>
<td></td>
</tr>
<tr>
<td>Honors</td>
<td>-0.06</td>
<td>-0.32</td>
<td>-0.21</td>
<td>-0.12</td>
</tr>
<tr>
<td>(0.26)</td>
<td>(0.29)</td>
<td>(0.25)</td>
<td>(0.23)</td>
<td></td>
</tr>
</tbody>
</table>

*p<.10, **p<.05, ***p<.01

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Similar to regression results of EnjoyOverall, the original regression analyses on ConnectOverall found no statistical significance for Treatment or for any other independent variable. Given that ConnectOverall was a simple average of the responses from individual artworks, each of the four Connect dependent variables was then regressed separately.

There was a statistically significant inverse relationship between Treatment and Café Terrace at Night. This indicated that exposure to Treatment decreased participants’ reported strengths of connection. Treatment was almost negatively significant for Catedral, and it is predicted that with a larger sample size this variable would become statistically significant. Both Café Terrace at Night and White Light had a statistically significant negative relationship with Male. This indicated that if a participant was male, his reported strength of connection to both of these works would be lower than his female counterpart. Once again, regression on The Persistence of Memory found no statistical significance to report.

The additional variables ConnectNoPollock, ConnectRealistic and ConnectAbstract allowed for further analysis. For ConnectNoPollock, regression analyses resulted in statistical significance for Treatment. This makes sense, given that Treatment was almost statistically significant in ConnectOverall – removing Pollock allowed Treatment to gain statistical significance. This indicated that participants exposed to Treatment would decrease their reported strength of connection overall to Café Terrace at Night, The Persistence of Memory, and Catedral.

For ConnectRealistic, Treatment became negatively significant and Male gained negative significance as well. This is plausible given that both Treatment and Male were negatively significant for Café Terrace at Night and Treatment was almost negatively significant for Catedral. For ConnectAbstract, regression analyses resulted in no statistical significance for either Treatment or any other independent variable. This was not surprising given that regression for The Persistence of Memory found no statistical significance, while regression for White Light only found statistical significance for Male at the highest level.

Though achieving statistical significance in the Honors variable was anticipated, not a single regression found any significance to report. It must also be noted that both R² and adjusted R² were low for all regression models. Low levels could have been due to a combination of the statistical insignificance of the independent variable Honors in all regressions, the insignificance of Class in most regressions, or the insignificance of Treatment in many regressions. These levels also suggest that a variable not tested in these regressions may have accounted for significance in the dependent variables. This is not surprising, given earlier discussion on the high level of subjectivity in perception of art. Though these levels are low, regression results are worthy of discussion.

### Discussion

**Conclusions**

Results of this study were surprising and warrant sufficient discussion. On average, participants reported that they enjoyed the artworks more than they felt a connection to them; their responses also varied less when reporting enjoyment than when reporting connection regardless of whether they received context information or not. Average reported level of enjoyment for all works fell between “Undecided” and “Somewhat Enjoyed It“, while reported strength of connection fell between “Undecided” and “Somewhat Not Strong.” Based on this result, it is plausible to suggest that it was more difficult for a participant to find a point of connection between the content of the artwork and him/herself than it was is to simply enjoy it. Connection with a piece of artwork requires the additional effort of internal reflection, and a viewer may need a better incentive structure not achieved by this design. Overall, none of the results would support a strong case claiming that most participants truly loved their survey experience.
In the original regressions on the primary dependent variable EnjoyOverall and secondary dependent variable ConnectOverall, the primary explanatory variable Treatment never achieved statistical significance. Not only was Treatment not always statistically significant, when it was significant it negatively affected participant reports on average. These results do not support the prediction that context information would significantly and positively affect participant reports. Even when they were not statistically significant, findings from the coefficients for Treatment suggest that, on average, exposure to context information negatively affected participant reports on every question when viewing all artworks other than Jackson Pollock’s White Light. Though surprising at first, after more careful consideration the potential explanation is that when participants believe in their own ability to interpret art, and when the presence of information contradicts or disenchants their understanding, a piece of the “magic” becomes lost. Recalling the statements of popular modern behavioral economist Dan Ariely on this circumstance in particular Ariely believes that:

Ownership is not limited to material things. It can also apply to points of view. Once we take ownership of an idea ...we love it perhaps more than we should... And most frequently, we have trouble letting go of it because we can’t stand the idea of its loss. (Ariely, 2010)

Perhaps only for an extremely abstract work, as in the case of White Light, was the addition of context information helpful for participants to develop a framework to understand it.

The investigation of Pollock’s White Light reveals that the work functioned more similarly to a dark horse than to what its name suggests. Not only did it muddle significance for Treatment across the board, when measuring the primary dependent variable, enjoyment, participants reported their enjoyment of it lowest of the four works while their responses to it varied more than to any other work. When measuring the secondary dependent variable, connection, participants reported their enjoyment of White Light lowest of the four works again even though responses to it were slightly less varied (second-highest of the four).

White Light inspired the inquiry that ultimately resulted in the separation of the artworks into two categories – realistic and abstract – and revealed one of the most interesting aspects of this study. When reports for the four artworks were split, it was possible to isolate independent variables affecting participant overall responses to a particular classification of artwork rather than to four unique individuals’ work or the combination of all works. On average, participants reported higher levels of enjoyment and connection to the realistic works Café Terrace at Night and Catedral than to the abstract works White Light and The Persistence of Memory. It must be noted, however, that both reported enjoyment and connection to White Light individually was low enough to bring the overall enjoyment and connection to the abstract works down lower than that of the realistic works. Regarding enjoyment, on average responses for the abstract works varied more than for the realistic works. This result contrasts responses for connection, where, on average, they vary more for the realistic works than for the abstract works. This is a very interesting result, likely explained by the fact that in this case the realistic artwork Catedral and not the abstract work White Light had the highest individual sample variance. Furthermore, it is possible that responses varied more for Catedral than for any other work if enjoyment was not influenced as much by recognition; given that Catedral is not at all famous, some participants may have connected with it more for this reason while others may have felt a lack of connection for this same reason. Finally, on average, participants reported highest enjoyment and connection to Van Gogh’s Café Terrace at Night over any other individual work. It is likely that this work was also the most widely recognizable of the collection, and further research should determine recognition of pieces in its design.

Though it was predicted that context information would be the primary variable affecting participant reports, regression analyses indicated that the independent variable Male reached statistical significance several times regardless of control or treatment. In every instance where Male was significant, being male decreased both reported level of enjoyment and reported strength of connection. Though this study provides support of a potential gender difference, this does not generalize the data for the population. One explanation may be that this result was correlated with an existence and compliance with social gender roles in the University of Arkansas environment that place lower value on expressing enjoyment of/connection with the arts for males than for females. Knowing that approximately 40% of participants in this study
were males, arts educators may find it beneficial to acknowledge this possibility and contemplate potential strategies to combat it.

The lack of significance in the Honors variable was surprising and requires additional inquiry. The negative statistical significance of the variable Class for White Light was also difficult to interpret; however, the relationship may be related to the possibility that upperclassmen were disenchanted by Pollock’s work if they had not already developed an appreciation for it. Finally, given that 63% of participants reported that they had previously visited nearby Crystal Bridges Museum of American Art, museums may find it beneficial to cater at least some programming to the interests of university students. When available, they may even find it beneficial to provide incentives that ensure students’ intentions to visit or revisit translate into actually walking through their doors.

Choosing to survey University of Arkansas students voluntarily enrolled in an art history course controlled for multiple factors. First, sample choice controlled for the wide range in the levels of exposure that the population has for viewing visual art. Though this design could not control for all variance, testing students in an art history course guaranteed that all students had been exposure to images of visual art at least once before taking the survey. In addition, testing this study’s research questions on university students, provided insight into the minds of relative peers. This is extremely helpful for creating art education programming strategies that successfully reach the university audience.

This experimental design provided control participants with artist name and title of work rather than no text information at all in order to isolate and investigate not just the effect of information at all, but specifically the effect of the contextual “story” behind the creation of works of art. Had control participants viewed visual art only, it would not be possible to conclude with confidence that context information specifically and not the recognition of artist name/title of work caused a statistically significant change in reported levels of enjoyment or strength of connection. This was a risk for finding significance; however, this study was more interested in testing precision of information.

Limitations

This study revealed multiple limitations and a discussion of them are below.

**Hypothetical bias.** While the increased aesthetic distance of viewing art on a digital screen versus seeing the art in person was controlled and identical for all works, there was an inherent disadvantage in asking participants to view visual art online rather than experiencing the art in reality.

**Control of exposure.** Though it was guaranteed that participants had been previously exposed to visual art, all works in this study date from the Post-Impressionist time period forward while participants’ exposure to visual art at the time of study was guaranteed only for works prior to the Post-Impressionist period.

**Resources.** This study was conducted without financial resources for implementation or compensation to participants.

**Omitted variables.** The greatest limitation overall for research of this nature revealed that quantitatively measuring perceptions of art is extremely difficult. Given the lack of empirical literature, the probability of an omitted variable bias was higher for a study of this kind than for other studies with a large body of reference. Though it was already suspected that additional variables other than context information affect perceived values of visual art, low R² levels in regression analyses provide statistical support that additional, untested variables likely affected participant perceptions while viewing visual art.

Future Research

The results of this study provide quantitative insight into variables that affect participant perceptions of the intrinsic values of visual art. Specifically, this study provides a closer look at the perceptions that members of the university community carry with them as they experience visual art. This, in turn, contributes to the body of knowledge for researchers who wish to take on the challenge of integrating quantitative analysis with artistic expression, and investigating and identifying more robust variables. In a future study, adding to context the impact of an artwork on following artists and movements may enhance viewer’s enjoyment...
and connection. The insights provided by this study are by no means comprehensive; however, multiple bodies from individuals to larger organizations involved in the arts may find the results of this study useful.

As the world enters an era of unprecedented interdependence, the university population and the millennial generation as a whole may no longer be satisfied by the blind consumption of information. This generation may demand to interact with and integrate their opportunities to critique, organize and draw their own conclusions regarding visual art as well as their daily, environmental experiences. If this is true, then the future of arts programming for the millennial generation knows no limit. Furthermore, if this prediction is investigated empirically, then those who create, collect, organize or distribute art for the millennial generation will have unprecedented capacity to choose and implement strategies to engage them successfully. By listening and responding to the needs of this generation, arts programming may sustain a healthy environment for growth, innovation and integration for generations to come.

References


Solid-State Transformers for Interfacing Solar Panels to the Power Grid
An Optimum Design Methodology of a High Frequency Transformer for dc-dc Converter Applications

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Department of Electrical Engineering

Faculty Mentor: Dr. Juan Carlos Balda
Department of Electrical Engineering

Abstract

Nowadays the use of power electronic interfaces to integrate distributed generation with the power grid is becoming relevant due to the increased penetration of renewable energy sources like solar, and the continued interest to move to a smarter and more robust electric grid. Those interfaces, which also provide a voltage step-up or step-down function, are of particular interest because renewable energy sources do not always have voltages compatible with the connecting grid. Among them, the so-called “power electronic transformer” or “solid-state transformer” (SST) is the focus of significant research. Advantages such as bidirectional power flow, improved system control, reduced size, and premium power quality at the output terminals, increase the interest of the SST for future electric grids. The SST consists mainly of two components: a high-frequency transformer (made out of advanced magnetic materials) and power converters (employing efficient power semiconductor devices like those based on silicon carbide (SiC)) to enable operation at frequencies higher than the grid frequency. This paper presents an optimum design method that can be employed to build a high-frequency transformer for a SST intended to interface a renewable energy source (e.g., a photovoltaic system) to the electric grid. Core material, geometry, and size will be analyzed in order to provide an optimum balance between cost, efficiency, thermal management, and size. Special consideration will also be given to the selection of the winding conductors given the skin effect associated with operation at high frequencies.

Keywords—transformer design, solid-state transformer, dual-active bridge.

I. INTRODUCTION

The solid-state transformer (SST), a proposed replacement for the conventional 50/60Hz line-frequency transformer (LF-XFMR), will utilize high-frequency switching converter topologies, such as the dual active bridge, to achieve many of the necessary functionalities demanded in future smart grids. Such functionalities include bidirectional power flow, intelligent system control, reduced size, and premium power quality. A converter is a power electronic interface that can perform either dc-dc, ac-dc or dc-ac power conversion using power semiconductor, such as silicon carbide (SiC). Such a converter, the dual active bridge (DAB), is utilized in the SST to perform dc-dc conversion and acts as the front-end interface for solar panels and battery storage units. The process by which this is accomplished begins with a dc voltage input (solar/battery), which is inverted into a high-frequency ac voltage, stepped up or down by the high-frequency transformer, then rectified back to a dc voltage as illustrated in Fig. 1 (X. She, R. Burgos, G. Wang, F. Wang, A.Q. Huang 2012). Though the various power SST topologies are not the subject of this research, it should be noted that based on the application and design, various types of conversions can be achieved such as ac-dc, dc-dc, or dc-ac with a number of different intermittent stages that offer the output of high or low voltage dc links. In the case of photovoltaic (PV) applications, where the output of a PV system is dc, the standard dc-dc DAB-based SST topology would be employed to convert the power delivered by the PV array to transmission or distribution voltage levels before being interfaced with the grid by a grid-tied inverter (S. Falcones, M. Xiaolin, R. Ayyanar 2010).

At the heart of the DAB is the HF-XFMR. A transformer is a voltage conversion component that steps up/steps down an ac signal from one voltage level to another by magnetically coupling two sets
of conductive windings using a magnetic core. Transformers are also utilized in applications requiring galvanic isolation and impedance matching between a source and a load. A key characteristic of a transformer is its dependency on the ac signal’s frequency, which holds an inverse relationship with the transformer’s size. In other words, higher frequency operation leads to transformers that are reduced in size (W.G. Hurley, W.H. Wolfle 2013).

Transformers are also utilized in applications requiring galvanic isolation and impedance matching between a source and a load. A key characteristic of a transformer is its dependency on the ac signal’s frequency, which holds an inverse relationship with the transformer’s size. In other words, higher frequency operation leads to transformers that are reduced in size (W.G. Hurley, W.H. Wolfle 2013).

Recent research in HF-XFMR design has presented techniques to engineers that will allow them to not only maximize efficiency with reduced size, but also utilize the leakage inductance of the equivalent circuit model in lieu of the standard external inductor implemented in the DAB topology. Researchers (K.D. Hoang, J. Wang 2012), (B. Cougo, J.W. Kolar 2012), and (P.A. Janse Van Rensburg, H.C. Ferreira 2004) describe the sizing of the leakage inductance of the transformer as being predominantly dependent on the geometry of the magnetic core and the winding scheme.

This paper presents an optimum transformer design method that can be employed to build a high-frequency transformer for a SST intended to interface a renewable energy source (e.g., a photovoltaic system) to the electric grid. Core material, geometry, and size will be analyzed in order to provide an optimum balance between cost, efficiency, thermal management, and size. Special consideration will also be given to the selection of the winding conductors given the skin effect associated with operation at high frequencies. To this end, this paper is organized as follows: relevant design considerations are given in section II, the proposed transformer design methodology is presented in section III, and a case study is provided in section IV. Finally, project conclusions and future work are addressed in section V.

II. DESIGN CONSIDERATIONS

Though the HF-XFMR will be an essential component of the power systems of the future and offers many benefits, several obstacles accompany the design process. This is due to the special considerations involved with the soft magnetic materials used to build the transformer, the increased copper winding resistances due to the skin effect, power loss calculation adjustments based on the non-sinusoidal input currents from the power electronic converters, and the thermal management issues surrounding the systems reduced size (T. Filchev, J. Clare, P. Wheeler, R. Richardson 2009). All of this must be taken into account while also keeping cost and efficiency in mind.

Magnetic materials come in two main varieties -- soft and hard magnetic materials. Hard magnetic materials are distinguished by their larger hysteresis loop under higher magnetic field intensities. This results in the need for a strong reverse magnetic field (low permeability) in order to change the flux density inside of the material. Soft magnetic materials do not require such strong magnetic fields (high permeability) to become fully magnetized or demagnetized, a

![Figure 1: Solid State Transformer based on Dual Active Bridge](image-url)
property that is employed in many power electronics today (W.G. Hurley, W.H. Wolfle 2013). Amorphous, ferrite, and nanocrystalline are soft magnetic materials presenting other desirable core characteristics (e.g., size reduction) that make them suitable to realize the HF-XFMR. Several of their properties are presented in Table I.

### Table I. Magnetic Material Properties

<table>
<thead>
<tr>
<th>Model</th>
<th>Amorphous</th>
<th>Ferrite</th>
<th>Nanocrystalline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permeability (µi)</td>
<td>Metglas 2605</td>
<td>Epcos N87</td>
<td>Vitroperm 500F</td>
</tr>
<tr>
<td>Bmax (T)</td>
<td>1.56</td>
<td>0.49</td>
<td>1.2</td>
</tr>
<tr>
<td>Curie Temp. °C</td>
<td>399</td>
<td>210</td>
<td>600</td>
</tr>
<tr>
<td>K_c</td>
<td>0.053</td>
<td>16.9</td>
<td>2.3</td>
</tr>
<tr>
<td>α</td>
<td>1.81</td>
<td>1.25</td>
<td>1.32</td>
</tr>
<tr>
<td>β</td>
<td>1.74</td>
<td>2.35</td>
<td>2.10</td>
</tr>
</tbody>
</table>

Ferrite materials provide generally less expensive alternatives to newer materials such as amorphous and nanocrystalline; however they exhibit higher core losses per unit volume and are only suitable for temperatures up to 210 °C. Nanocrystalline is a premium material and is a suitable choice for extreme environments with relatively low losses per unit volume. However, nanocrystalline is more expensive than other materials and is still only manufactured in limited shapes and quantities. Amorphous presents the best balance between cost, losses per unit volume, operating temperature, and availability.

#### A. Core Losses

The analysis of the different soft materials requires evaluating the core losses due to eddy currents and hysteresis loops. If the magnetic core is conductive, in accordance with Faraday’s law, eddy currents will be induced inside of it to oppose the change in the core’s magnetic field. The intrinsic resistivity of the core and these currents will create losses in the form of heat dissipation.

Fortunately, prior research has been conducted to aid in the design of a HF-XFMR in order to meet application, size, and efficiency requirements. When considering the core losses, traditionally measured in loss per unit volume (W/m3), the Steinmetz equation has been the standard model:

\[
\text{P}_{fe} = K_c f B_{max}^\beta
\]

where \( K_c \), \( α \), and \( β \) are constants typically provided by the manufacturer, or can be extrapolated from losses per unit volume graphs accompanying the core of choice. The maximum flux density at which the core is designed to operate is \( B_{max} \) and \( f \) is the excitation frequency. It can be seen that the core losses are proportional to the frequency and flux density while the size of the core is inversely proportional to frequency. There is a tradeoff between efficiency and size that the designer will need to consider.

One disadvantage of the Steinmetz equation is that it only considers sinusoidal inputs. For all SST applications, because of the discrete switching in the converters, square waveforms are generated and fed to the HF-XFMR. For more precise loss calculations, the improved General Steinmetz Equation (iGSE) must be used to accurately predict the core losses when factoring in non-sinusoidal excitation (W.G. Hurley, W.H. Wolfle 2013):

\[
P_v = \frac{1}{T} \int_0^T k_i \left| \frac{dB(t)}{dt} \right|^\alpha |\Delta B|^{\beta-\alpha} \, dt
\]

Simplyfying (2):

\[
P_v = k_i |\Delta B|^{\beta-\alpha} \left| \frac{dB(t)}{dt} \right|^\alpha
\]

where \( \Delta B \) is the peak-to-peak flux density and \( k_i \) is expressed as:

\[
k_i = \left( \frac{K_c}{2^{\beta-1} \pi^{\alpha-1} \int_{2\pi}^0 |\cos(\theta)|^\alpha d\theta} \right)
\]

An accurate substitution for \( k_i \), assuming square wave excitation, is:

\[
k_i = \frac{K_c}{2^{\beta-1} \pi^{\alpha-1} \left( 1.1044 + \frac{6.8244}{\alpha + 1.354} \right)}
\]

Finally, taking the piecewise behavior of the square waveform into account, the iGSE can be rewritten using a piecewise linear model as a function of the duty cycle of the signal:

\[
P_v = k_i |\Delta B|^{\beta-\alpha} \frac{1}{T} |\Delta B|^{\alpha} \left[ (DT)^{1-\alpha} + [(1-D)T]^{1-\alpha} \right]
\]

These sets of equations will be used to estimate core losses during the initial design of the transformer. Subsequent design practices will be explored such that the user of the proposed methodology will be able to define system parameters to factor in when designing a
B. Winding Losses

Winding losses occur in the windings due to the intrinsic resistivity of the conductor coupled with the skin effect, a phenomenon associated with higher frequencies, and proximity effect. When calculating the losses due to these effects, it is difficult to keep them separate from one another. For simplicity, they will be referred to as eddy current losses and are largely results of the skin effect \( \varepsilon \) (J.P. Vandelac, P.D. Ziogas 1988).

\[
\varepsilon = \frac{6.662}{\sqrt{f}} \tag{7}
\]

A simple model of the copper losses \( P_{cu} \) in transformers using single conductor wire can be derived by applying Ohm’s law and by considering the geometry of the transformer and windings:

\[
P_{cu} = \rho_w \sum_{i=1}^{n} N_i MLT \left( J_i A_w \right)^2 \tag{8}
\]

where \( \rho_w \) is the resistivity of the winding conductor, \( MLT \) is the mean length per turn, \( N_i \) the number of turns, \( J_i \) the effective current density, and \( A_w \) is the cross sectional area of the conductor with skin effect. These parameters are all a product of the core geometry and provide for a comprehensive copper loss equation (W. Hurley, W.H. Wolfle, J.G. Breslin 1998)

This process is complicated when the designer chooses to utilize litz wire (multistrand) as the conductor. Litz wire is often the best choice because of the skin effect on single conductor windings and the large currents seen in higher power transformers. In the process of selecting litz wire, it is important to establish the cross-sectional area of the conductor as a function of the optimum current density before choosing a strand count and gauge.

\[
J = K_i \frac{\Delta T}{\sqrt{2 ku}} \left( \frac{1}{8 \sqrt{A_p}} \right) \tag{9}
\]

\[
K_i = 48.2 \times 10^3 \tag{10}
\]

Dividing the current in the primary and secondary by the optimum current density yields the total cross-sectional area of the windings needed to facilitate the current on both sides of the HF-XFMR. The appropriate wire gauge, number of strands in the litz wire, and total equivalent resistance of each set of windings can be extrapolated from these two parameters and the resistivity of the copper.

C. Optimum Flux Density

When considering transformer core sizing, the area product \( (A_p) \) is a useful dimensional tool, both in general sizing and as a key design component. The area product is the product of the cross section area and the window area of the core. Reference (W.G. Hurley, W.H. Wolfle 2013) presents a method to derive an optimum area product by considering \( B_o \) the optimum flux density and \( J_o \) the corresponding current density:

\[
A_p = \left[ \frac{\sqrt{2} \sum VA}{K_o B_o k_f k_t ku \Delta T} \right]^{8/7} \tag{11}
\]

where \( \sum VA \) is the volt-ampere rating of the windings (typically twice that of the power rating of the transformer), \( K_v \) is the waveform factor approximation (4.44 for sinusoidal and 4 for square), \( k_f \) is the core-stacking factor, \( K_t \) is a constant, \( k_u \) is the window area utilization factor, and \( \Delta T \) is the transformer temperature rise.

From this, an expression for the optimum flux density as a function of this area product and other key system parameters can be developed by making substitutions for the copper and core losses in governing transformer power equations. Extracting the optimum flux density can then be completed and is expressed as:

\[
B_o = \frac{\left( \frac{h_c k_a \Delta T}{\sqrt{2 k_w k_u}} \right)^{3/2} \left( \frac{K_o k_f k_u}{\sqrt{2}} \right)^{1/7} \sum VA^{1/6}}{2^{5} \rho_w k_w k_u^{1/2} k_c k_t^{1/2}} \tag{12}
\]

The flux density is limited by the saturation flux density of the chosen core material. This must be taken into account when selecting the magnetic components of the transformer and could be a factor in the overall size and cost of the device. This equation should be utilized if the efficiency is of critical importance in the design.

D. Specific Leakage Inductance

As mentioned before, efficiency may not always be the highest priority, but the design of the transformer such that the inductance required for maximum power transfer in the DAB topology could be fully integrated as the transformer leakage inductance. In this case, the designer should be
afforded the flexibility to simply choose an operating flux density, keeping in mind the saturation flux density of the core material selected. To minimize size and maximize power density while adhering to the limitations of the core material, best practice is to select an operating flux density at least 10% lower than the saturation flux density (G. Ortiz, J. Biela, J.W. Kolar 2010). An expression for the leakage inductance of a standard shell-type transformer core construction with both sets of windings wound around the center leg is:

\[ L_\phi = \frac{N_p^2 \mu MLT h}{3w} \]  

where \( L_\phi \) is the leakage inductance, \( N_p \) is the number of turns in the primary, \( \mu \) is the permeability of free space (a constant), \( MLT \) is the mean length per turn of the windings, \( h \) is the window height, and \( w \) is the window width. The \( MLT \) is a function of the core geometry:

\[ MLT = 2(a + d) + 0.8w(2 + \pi) \]  

where \( a \) and \( d \) are the lengths of the two sides of the transformer leg which the windings will be wrapped around and \( w \) is the window width. The E-type transformer core construction is the simplest in terms of leakage inductance control and thermal management because windings are wrapped around a center leg with two outer legs that aid in collecting, what would otherwise be stray magnetic field lines (B. Cougo, J.W. Kolar 2012).

\[ III. \text{ PROPOSED METHODOLOGY} \]

The methodology presented is optimized for designs requiring specific leakage inductances to meet DAB specifications. (J.P. Vandelac, P.D. Ziogas 1988), and (W. Hurley, W.H. Wolfe, J.G. Breslin 1998) outline effective means to minimize core and copper losses in order to maximize system efficiency while reducing size. Researchers (K.D. Hoang, J. Wang 2012), (B. Cougo, J.W. Kolar 2012), (P.A. Janse Van Rensburg, H.C. Ferreira 2004), and (G. Ortiz, J. Biela, J.W. Kolar 2010) present methods to achieve specific transformer equivalent circuit parameters. The proposed method is holistic in the sense that it provides insight from these different studies to provide the designer flexibility.

Regardless of application, an essential set of system parameters is first defined. This includes the power rating, desired efficiency, terminal voltages, planned temperature rise, switching frequency, duty cycle, the turns ratio, and desired leakage inductance. Following this, a core material is selected and its material parameters are documented. If efficiency is desired, equations (11) and (12) may be used to derive the optimum flux density and area product of the core. If size reduction or a specific leakage inductance is required, an operating flux density may be chosen, keeping in mind that it be at least 10% less than the saturation flux density of the material. Next, a core is selected along with its dimensions. From this, equation (14) is used to obtain the \( MLT \). For applications requiring a specific leakage inductance, equation (13) may be solved for \( N_p \). \( N_S \) can be shown then by dividing \( N_p \) by the turns ratio (\( N \)).

At this point, two checks can be done to verify design feasibility. Applying Faraday’s Law, the flux density of the selected core can be derived to ensure that the core will not saturate. If the leakage inductance is a critical design concern, the number of turns on the primary and secondary can be rounded down to the nearest whole number, to prevent the inductance from becoming larger than intended, and plugged into equation (13).

Once these design checks are confirmed, winding parameters can then be obtained. The skin effect and optimum current density can be calculated using equations (7), (9), and (10). The skin effect is the principle determinant of the required wire gauge, though a smaller gauge may be used. A larger than required gauge will result in an unnecessary increase in conductor volume. The current density yields the total necessary cross-sectional area of the windings which, when divided by the selected gauge of wires area, gives the total number of strands needed in the litz wire.
Another design check before continuing to the loss calculations is recommended. It may be possible that the selected conductors, with the number of turns, may not actually fit in the window area of the transformer core. Performing this simple check will ensure the transformer can be realized physically.

Finally, using the methods defined in section II.A, the total losses, both in the core and windings, can be calculated. Once all losses are compiled, the efficiency can be derived. If for any reason the transformer does not meet efficiency requirements, the process must reiterate from block two. If losses are too high, lowering the operating flux density or selecting a different core material will yield better results.

**IV. CASE STUDY**

For future SST projects to work, the SSEES lab requested a transformer for use in a three level full-bridge based DAB. Preliminary system specifications were first outlined, as shown in Table II. This transformer will be designed to meet a specific leakage inductance requirement, with an efficiency of 95% using an amorphous core in a shell-type transformer core construction for thermal management purposes.

With these system parameters in place, the core parameters are then compiled, along with the turns ratio necessary, to achieve the input and output voltages in Table III.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Rating ((P))</td>
<td>5kW</td>
</tr>
<tr>
<td>Efficiency ((\eta))</td>
<td>98%</td>
</tr>
<tr>
<td>Primary Voltage ((V_p))</td>
<td>600V</td>
</tr>
<tr>
<td>Secondary Voltage ((V_s))</td>
<td>60V</td>
</tr>
<tr>
<td>Temperature Rise ((\Delta T))</td>
<td>70 °C</td>
</tr>
<tr>
<td>Switching Frequency ((f))</td>
<td>20kHz</td>
</tr>
<tr>
<td>Duty Cycle ((D))</td>
<td>50%</td>
</tr>
<tr>
<td>Leakage Inductance ((L_p))</td>
<td>405 μH</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turns Ratio ((N))</td>
<td>10</td>
</tr>
<tr>
<td>(K_c)</td>
<td>0.053</td>
</tr>
<tr>
<td>(\alpha)</td>
<td>1.81</td>
</tr>
<tr>
<td>(\beta)</td>
<td>1.74</td>
</tr>
<tr>
<td>Saturation Flux Density ((B_{MAX}))</td>
<td>1.56 T</td>
</tr>
<tr>
<td>Operating Flux Density ((B_o))</td>
<td>0.5 T</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leg Width ((a))</td>
<td>0.032m</td>
</tr>
<tr>
<td>Leg Depth ((d))</td>
<td>0.025m</td>
</tr>
<tr>
<td>Window Height ((h))</td>
<td>0.07m</td>
</tr>
<tr>
<td>Window Width ((w))</td>
<td>0.02m</td>
</tr>
<tr>
<td>(MLT)</td>
<td>0.196m</td>
</tr>
<tr>
<td>Number of primary turns ((N_p))</td>
<td>37.5 ~ 30-</td>
</tr>
<tr>
<td>Number of secondary turns ((N_q))</td>
<td>3.75 ~ 3</td>
</tr>
</tbody>
</table>
Using equation (11) to find an optimum area product using the operating flux density yields 23cm². At this time it became apparent that a transformer core this small would not accommodate the windings and a larger core was selected. Adjustments were made later to accommodate this size increase. The AMCC-50 C-Core was selected and four of them will be combined to create the shell-type geometry with a total area product of 112cm². Equation (14) was used to derive the MLT while equation (13) was used to solve for the number of turns in the primary. The dimensions, along with the resulting MLT and numbers of turns, are listed in Table IV.

Equation (7) gives a skin effect radius of 0.0468cm, which leads to an effective cross-sectional area maximum of 6.9x10⁻³ cm². The current density is found to be 250.1 A/cm². The litz wire selected was 36AWG/259 strands with a cross sectional area of 127x10⁻⁶ cm². A single wire of this type will accommodate the current in the primary, but because the secondary will conduct a current 10x larger than the primary, these windings will require 10 of these wires be used in parallel. Using the MLT, number of turns, and the resistivity (13610 μΩ/cm) of the conductor, the primary and secondary equivalent resistances were found to be 26.27Ω and 2.627Ω respectively.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Losses (P_{fe})</td>
<td>235.4 W</td>
</tr>
<tr>
<td>Copper Losses (P_{cu})</td>
<td>2.19 W</td>
</tr>
<tr>
<td>Total Losses (P_{TOT})</td>
<td>237.6 W</td>
</tr>
<tr>
<td>Efficiency (\eta)</td>
<td>95.5%</td>
</tr>
</tbody>
</table>

Performing the window area check shows that the windings will fit the window area with this litz wire and its required number of turns.

A final loss check is performed using the methods outlined in Sections II.A and II.B. See Table V for results.

V. CONCLUSIONS AND FUTURE WORK

This research developed and demonstrated the feasibility of the proposed HF-XFMR design methodology by presenting a case study. It is shown that there is a trade-off between size, efficiency, and cost when considering transformer design. For most applications where size and efficiency are critical components, materials like amorphous and nanocrystalline are desirable. However, in cases where cost is a factor, amorphous and ferrite are more suitable. Amorphous presents the best balance of cost, losses per unit volume, maximum temperature, and availability.

As shown, a transformer design aimed at satisfying specific leakage inductance requirements puts constraints on core size and winding turns. This oftentimes negates the calculation of an optimum flux density and area product. It is best, in these cases, to choose a flux density that matches with a specific area product such that the dimensions of the core allow for the design to accommodate the desired leakage inductance. Because of this, the process becomes reiterative in order to maximize efficiency and minimize size while meeting these requirements.

The transformer designed in this case study will be constructed and used for future SST project research in the SSEES lab at the University of Arkansas. Future work will include constructing and testing this transformer and implementing it in a 3 level full bridge based DAB topology. An analysis of thermal management options may follow.

ACKNOWLEDGMENT

Kenny George would like to thank the Arkansas Science and Technology Authority for the opportunity and financial support to conduct this summer research project. Kenny would also like to thank Dr. Juan Balda, Andres Escobar, and Roderick Garcia for their continued support and guidance in his academic pursuits.

REFERENCES


Investigating Disparities in Behavior and Care between Alaska Native and Non-Hispanic White Victims of Sexual Violence: The Importance of Culturally Competent Nursing Care

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College of Education and Health Professions

Abstract

The purpose of this research was to determine the existence of health care disparities experienced by Alaska Native women victims of sexual violence and to address the need for sexual assault nurse examiners (SANEs) to provide culturally competent care. This was a secondary data analysis of research collected from over 1,600 Alaska SANE surveys between 1996-2006. Variables investigated included: behaviors during examination, condition during assault, time from assault to report, hospital admittance, injuries sustained, and victim-suspect relationships. Alaska Native women were described as having less controlled behavior, being less cooperative, and less likely to be sober; they also often suffered more physically traumatic assaults than non-Hispanic white women victims. This research provides support for the need to include cultural competency training in the preparation curriculum for SANEs working with the Alaska Native population and urges SANEs to collaborate with cultural groups to ensure the delivery of culturally sensitive care.

Background and Significance

“Alaska has an epidemic. It’s not bear attacks or deadly roads. It’s rape and violence against women” (Sutter, 2014, p. 1). This poignant statement from Alaska Governor, Sean Parnell, is emblematic of a growing public health issue that has plagued the state for decades. The average rate of forcible rape reported to law enforcement from 1996-2006 was 77.8 per 100,000 individuals in Alaska as compared to 33.1 per 100,000 individuals in the contiguous U.S. and Hawaii (Rosay, 2006). According to the 2012 FBI crime estimates, reported rape is more common in Alaska than any other state; the per capita rate of rape is about three times the national average (U.S. Department of Justice, 2012). Data indicate that while one in five women has been sexually assaulted in her lifetime in the United States (Black et al., 2011), over one-third of adult women (37%) in Alaska report having been victims of sexual assault (Rosay, 2011). In spite of these alarming statistics, rape is still underreported in Alaska (U.S. Department of Justice, 2012).

Researchers suggest multiple, complex factors to explain the higher rates of rape in Alaska. For example, Alaska Native communities are often “geographically isolated, and at an increased risk for alcoholism, unemployment, health problems and high poverty levels” (Office for Victims of Crime, 2012, p.1). Rural communities with minimal roads, little law enforcement presence, and an abundance of male-dominated industries are also listed as risk factors. In addition, a breakdown in family structure and a lack of discussion regarding sexual violence and alcohol abuse are attributed as probable factors. Linda Chamberlain, director of the Alaska Family Violence Project, notes that there are “so many factors that tip the scale for Alaska…it’s easier for perpetrators to isolate their victims and not get caught. And for people not to get help” (Bernard, 2014, p. 6-7). While silence has been the norm for several decades, a cycle of sexual violence has existed among Alaska Native communities. In regards to sexual or intimate partner violence, a public health nurse working in several Alaskan villages indicated that “people get mad when I say it’s become tradition, but it has. We’re talking about third-generation violence. That’s tradition” (Bernard, 2014, p. 18). The heightened and additive exposure to these traumas and stress has amplified the effect of sexual violence on tribal communities (Office for Victims of Crime, 2012).

Sexual assault is not only detrimental to the victims, it is pervasive and has far-reaching personal, social, and economic implications. For example, sexual violence can lead to unintended pregnancies, induced abortions, gynecological problems, and sexually
transmitted infections and disease, including human immunodeficiency virus (HIV). Sexual violence has been associated with depression and post-traumatic stress disorders. Sexual violence against Alaska Native women is more likely to result in injury, more likely to involve a weapon, and less likely to be reported by the victim than those of non-Hispanic white women in the United States (Bachman, Zaykowski, Kallmyer, Pateyeva, & Lanier, 2008). Drug and alcohol abuse are considered critical links that attribute to the heightened level of violence experienced by Alaska Native women. Because of complicated relations and regulations between tribal and state authorities, an environment has been created that aids attackers in getting away with violent crimes with little to no fear of facing legal consequences (Alleyne, n.d.). According to the U.S. Department of Health and Human Services, reducing sexual violence is a necessity for the well-being of individuals and is listed as a Healthy People 2020 goal [Objective IVP-40. (Healthy People, 2014)].

In the face of complex challenges brought about by sexual violence, the White House Council on Women and Girls has recently implemented a series of initiatives to protect Alaska Native women from sexual violence. Changes listed in this report include: increasing resources for hiring more law enforcement, strengthening victim services, and updating the protocol for Sexual Assault Medical Forensic Examinations (Office of Vice President, 2014). When victims seek help at a medical center following an incident of rape, the preferred standard of care is for them to meet with a sexual assault nurse examiner (SANE). In an effort to improve services to victims of rape, initiatives are underway to train a larger number of nurses to become Forensic Nurse Examiners in Alaska (Angaiak, 2014).

Organizational efforts within the healthcare field that provide sexual assault education and services to women have gained attention in the past 15 years. For example, in 2002, the Institute of Medicine (IOM) called for health professional organizations to develop and provide guidance to their members, constituents, institutions, and stakeholders regarding violence and abuse education. Specifically, these recommendations emphasized the need for organizations to provide guidance in terms of (1) competencies to be addressed in health professional curricula, (2) effective teaching strategies, and (3) approaches to achieving sustained behavior changes among health professionals (Cohn, Salmon, & Stobo, 2002).

Furthermore, the Academy on Violence and Abuse proposed a series of health system competencies, institutional competencies, and individual learner competencies that health care professionals should acquire to create a supportive environment where the system and clinicians model best practices related to violence and abuse (Ambuel et al., 2011). Despite these renewed and acclaimed efforts, the reports from the White House Council on Women and Girls, the IOM, and the Academy on Violence and Abuse have omitted the primacy of cultural competence as a fundamental skill that SANEs should obtain in order to better assist and care for the victims of sexual violence.

Health Disparities Experienced by the Alaska Native Population

According to the National Alaska Native American Indian Nurses Association (NANAINA), health disparities and the burden of illness and death are a major concern for Alaska Native populations (Parker, Haldane, Keltner, Strickland, & Tom-Orne, 2002). Alaska Native women are three times more likely to be victims of sexual assault or rape compared to non-Hispanic white, African American or Asian women (Bachman et al., 2008). Six out of ten American Indian/Alaska Native (AI/AN) women reported being physically assaulted in their lifetime (Oetzel & Duran, 2004).

The Alaska Native population has many markers of disadvantage worthy of discussion. For example, 32% of AI/ANs live below the poverty level compared to 13% of all races in the United States (Parker et al., 2002). The AI/AN infant mortality rate, which serves as an important measure and indicator of the health status of a population, is 30% higher than that for all races in the United States (Maurer & Smith, 2013). These statistics, along with several others that present a population possessing lower education levels and higher levels of unemployment, shed light on the quality of life disparities experienced by individuals in the expansive region of Alaska (Parker et al, 2002).

Underfunded healthcare systems available to AI/ANs negatively affect accessibility and quality of care. The Indian Health Service (IHS), an agency within the U.S. Department of Health and Human Services, provides federal health services to American Indian and Alaska Natives. Unfortunately, over the past few decades a pattern of underfunding has developed
which has contributed to the disparity in health status. For example, per capita funding for Native American health care is 60% less than the amount spent on the average American (Goodkind et al., 2010). With the IHS currently operating with 59% of what is needed to provide adequate healthcare, it is important for the government to immediately and earnestly reevaluate the amount of funding allocated for Native Americans (U.S. Commission on Civil Rights, 2003).

In addition, the rural and isolated nature of many Alaska Native women places unique barriers to receiving quality healthcare in the absence of a healthcare infrastructure, which can lead to increased risk of repeated violence for victims (Oetzel & Duran, 2004). Cultural barriers also present a challenge (Parker et al., 2002). For example, mainstream interventions commonly used to help women victims of violence are not uniquely designed for Alaska Natives and are “not necessarily consistent with cultural practices” (Oetzel & Duran, 2004, p.56). The National Institute of Justice acknowledged that there was a lack of understanding regarding the needs of the Alaska Native people (Crossland, Palmer, & Brooks, 2013). More accurate, comprehensive information is critically needed to gain a better understanding of the health disparities and healthcare needs of the Alaska Native population as compared to the rest of the country. The next section will focus on the importance of cultural competence when providing care to differing patient populations.

**Cultural Competence of Sexual Assault Nurse Examiners: A Core Necessity in Nursing Care Delivery**

Over the years, the landscape of the United States has morphed into a mosaic of diversity in terms of race, ethnicity, and cultural traditions. Alongside this richness, cultural and language barriers have emerged. In healthcare settings, culture and language differences may result in misunderstanding, decreased regimen compliance, decreased medication adherence and other factors that can negatively affect the short- and long-term health outcomes of patients. The Institute of Medicine has noted that (1) minorities receive lower quality of healthcare even when socioeconomic and access-related factors were controlled; and (2) bias, stereotyping, prejudice, and clinical uncertainty may contribute to racial and ethnic disparities in health care (Nelson, 2002).

Nurses are at the forefront of healthcare services and play a pivotal role in the provision of care. The diversity of cultures within our nation has made it imperative for nurses to become better trained in the ability to achieve cultural competence in healthcare settings. Cultural and linguistic competence is defined as a set of congruent behaviors, attitudes, and policies that come together in a system, in an agency, or among professionals; together, they enable effective work in cross-cultural situations (Bazron, Cross, Dennis, & Isaacs, 1989). The need for cultural awareness is fundamental in the delivery of effective, comprehensive, and respectful care for all patients. Given that Alaska Native women are living in an environment in which rape is more prevalent, more expected and perceived differently than in other cultures, it is vital that nurses receive cultural competency education. For example, historically, the sexual assault so many Alaska Native women experienced was considered *huklani*, or ‘bad luck’; considered taboo. A woman said discussing the abuse you experienced was “like, bad, you don’t talk like that, you don’t say that…you learn not to talk when you’re a kid” (Bernard, 2014, p.21). It is of paramount importance for nurses to consider the patient’s individual beliefs and behaviors as their oversight could lead to disparities in care (Office of Minority Health, 2013). The meaning that victims give to the sexual assault and the victims’ experiences of the post-assault services they receive are key in their recovery, healing and coping (Dudley et al., 2002).

Patients benefit when nurses learn more about health disparities and become proficient in their ability to provide culturally competent care for diverse groups. Specifically, patients who are treated by culturally competent medical practitioners may be more satisfied with their healthcare treatment and may, in turn, increase treatment compliance. Nurses must be more cognizant of cultural and linguistic barriers as well as their own biases that could affect their ability to provide culturally competent care. Yet, in providing care to Alaska Native patients, there is often a lack of concordance between patient needs and provider services. Concordance is the process of matching patient-provider racial, ethnic, and/or language characteristics. The underlying assumption is that sharing or at least understanding these characteristics leads to a higher degree of comfort, communication and empathy in clinical encounters. The topic of patient-provider racial, ethnic, and language concordance has propelled increasing interest...
as it relates to the lack of diversity in knowledge and practice in the healthcare workforce (Office of Minority Health, 2013). Nurses who are culturally competent are better equipped to incorporate Alaska Native women traditions and cultural beliefs into effective plans of care. In turn, this could create more concordance in the patient-provider relationship and reduce disparities.

In 2000 the United States Department of Health and Human Services Office of Minority Health released national standards for culturally and linguistically appropriate services (CLAS). These standards were intended to advance health equality, improve quality and help eliminate healthcare disparities (Lehman, Fenza, & Hollinger-Smith, 2012). In regards to this research, three standards stood out:

“CLAS 1: Provide effective, equitable, understandable and respectful quality care and services that are responsive to diverse cultural health beliefs and practices, preferred languages, health literacy and other communication needs

CLAS 3: Recruit, promote and support a culturally and linguistically diverse governance, leadership and workforce that are responsive to the population in the service area.

CLAS 4: Educate and train governance, leadership and workforce in culturally and linguistically appropriate policies and practices on an ongoing basis” (Office of Minority Health, 2013, p. 1).

In addition to the Department of Health and Human Services, another federal agency, The Joint Commission on Accreditation of Healthcare Organizations (JCAHO), works to improve safety and quality of care by accrediting healthcare organizations to improve performance. In their policies, JCAHO states they view the delivery of care in a culturally and linguistically appropriate manner as a safety and quality of care issue (Lehman et al., 2012).

Nurses working with diverse population groups need to be knowledgeable of cultural differences and need to continually grow in awareness and skills related to cultural discrepancies. A culturally competent nurse instills confidence in their patients and can improve patient satisfaction and compliance (Office of Minority Health, 2013). A major aspect of minimizing culturally insensitive care is to develop self-awareness. It is important for nurses to examine their own beliefs, values and behaviors to minimize the risk of stereotyping or discrimination. Another essential facet in respecting a patient’s culture is providing patient-centered care. Patient-centered care improves the patient-provider relationship and ensures the decisions made and actions taken respect the needs, wants and preferences of the patient.

Josepha Campinha-Bacote created a model that serves as a framework for implementing culturally responsive care in healthcare organizations. The model suggests that cultural competence is an ongoing process. In other words, healthcare providers must be actively working towards becoming more and more culturally competent to achieve the ability to efficiently work within the cultural context of the patient. The model is called “The Process of Cultural Competence in the Delivery of Healthcare Services” and it assumes that there is a direct relationship between the cultural competence of healthcare workers and their ability to deliver culturally sensitive care.

The model can be visualized symbolically as a volcano, with cultural desire serving as the catalyst that erupts into the process of cultural competence. Cultural desire is defined as the personal desire of the nurse to want to engage in the process of becoming culturally aware and knowledgeable. Once a healthcare provider harnesses the desire, they commit to caring for the patient, accepting differences and building on similarities, and being willing to learn about another culture. Once the desire is there, the process begins. Cultural awareness is associated with the self-examination mentioned above. It involves exploring personal biases, stereotypes and assumptions in order to avoid engaging in cultural imposition. Cultural knowledge involves seeking out and building a strong educational foundation about various cultural groups. By investigating the worldviews of patients, healthcare providers can obtain a stronger understanding of health-related beliefs and values (Campinha-Bacote, 2002). Cultural skill means having the ability to perform culturally-based physical assessments and provide culturally sensitive care (Campinha-Bacote, 2003). Madeleine Leininger, the founder of the theory of transcultural nursing, defined a cultural assessment as a “systematic appraisal or examination of individuals, groups and communities as to their cultural beliefs, values and practices to determine explicit needs and intervention practices within the context of the people...
being served” (Leininger, 1978, p. 85-86). Lastly, cultural encounters are instances in which the nurse directly interacts, face-to-face, with people from another culture. Interacting with people from other cultures expands personal perspectives and shifts thinking to prevent stereotyping (Campinha-Bacote, 2003).

In applying this model, Campinha-Bacote (2003) developed a mnemonic device for nurses and healthcare providers to review mentally to ensure they are providing culturally responsive services. The mnemonic “ASKED” (awareness, skill, knowledge, encounters, and desire) will help remind those providing care to a diverse population if they have “ASKED” themselves the right questions. An example of a question in regards to cultural awareness would be, “Have I examined my own personal assumptions in regards to this cultural group?” (Campinha-Bacote, 2003).

Including a model such as Campinha-Bacote’s in the training programs for sexual assault nurse examiners serving diverse patient populations would likely provide multiple benefits. SANEs who have received training in cultural competence are able to (a) demonstrate the importance of culture as a central factor in health care, (b) identify barriers to cultural understanding among providers and patients, and (c) assess and respond to differences in values, beliefs, and health behaviors (Lehman et al., 2012). Next, the role of the sexual assault nurse examiner will be discussed.

Sexual Assault Nurse Examiners (SANEs)

The Sexual Assault Nurse Examiner plays a pivotal role in post-assault care. Following the recognition of the heightened occurrence of sexual violence in tribal populations, the Office for Victims of Crime established the American Indian/Alaska Native Sexual Assault Nurse Examine-Sexual Assault Response Team (SANE-SART) Initiative. A sexual assault nurse examiner (SANE) is a registered nurse who has advanced education and extra clinical experience in forensic examination of sexual assault victims (Littel, 2001). A sexual assault response team (SART) is a multidisciplinary team consisting of a law enforcement officer, a local victim advocate and a specially trained health care professional (such as a SANE). The purposes of a SART team include: meeting the immediate needs of the victim, providing a joint, effective, sensitive approach to the victim, conducting a police investigation, and documenting collected evidence (Alaska Network on Domestic Violence & Sexual Assault, 2015).

The sexual assault nurse examiner has several tasks once a victim arrives post-assault, but their main task is to work to maintain the victim’s dignity and reduce psychological trauma (Henry & Force, 2011). The SANE meets with the patient and begins with a preliminary patient history to help prioritize care by identifying potentially emergent issues (Markowitz, 2007). The nurse conducts an in-depth interview and performs a physical exam, including a pelvic exam, in order to collect evidence that will be provided to law enforcement. SANEs collaborate with law enforcement officials and may be asked to testify in court. In addition, SANEs educate the victim about sexually transmitted infection and pregnancy risks, and make referrals for follow-up care if necessary (Henry & Force, 2011).

Research has shown the use of a SANE program improves effectiveness in several domains: psychological, medical, forensic, legal and community. When the nurses attend to the victims in a culturally competent manner, victims report that they feel safe, reassured, cared for and respected. The SANE programs have been found to provide more comprehensive and consistent medical care than typically provided in a normal Emergency Department setting. SANEs are trained and capable of collecting and recording evidence correctly. SANE programs also influence the political realm because survivors are more likely to participate in prosecution. With the evidence collected by SANEs during the exam, police are more likely to file charges, prosecutors are more likely to pursue prosecution, and attackers are more likely to be convicted. In regards to community change, SANE programs can help initiate improved relations and communication between health and legal professionals (Campbell, 2005).

SANE programs may be located in hospitals, community clinics, and police departments (Littel, 2001). According to the International Association of Forensic Nurses, Alaska, the state where rape is the most prevalent, has eight SANE programs. Alaska is the largest state in the U.S. spanning over 600,000 square miles. Texas is the second largest state with a little over 250,000 square miles; it has 41 SANE programs. In terms of comparison, Texas has one SANE program for every 6,500 square miles while Alaska has one SANE program for every 80,000 square miles. Although Alaska is not as densely populated, there are still over
200 native tribes inhabiting the vast landscape.

Recruiting and retaining qualified nurses to work with sexual assault victims is a difficult task; the turnover rate for a sexual assault nurse examiner in Alaska is typically two to three years (Angaiak, 2014). The high turnover rate in this position has been attributed to burnout as SANEs experience vicarious trauma, the cumulative effect on the helper working with others who have suffered traumatic life events. Providing SANEs with opportunities to express their concerns and enhancing support are important to maintain job retention (Logan, Cole, & Capillo, 2007). However, currently serving the Native Alaskan population is a group called the National Alaska Native American Indian Nurses Association (NANAINA). NANAINA represents nurses who are spread across the country positioned strategically in order to improve health outcomes for hard to reach populations. Although not all members of NANAINA are American Indian/Alaska Native, they work with native populations and promote culturally sensitive models of nursing interventions for their patients. NANAINA has the potential to significantly increase the number of qualified healthcare providers serving sexual assault victims; unfortunately, only a small number of their nurses are educated at the baccalaureate level, which is required in order to become a forensic nurse examiner (Parker et al., 2002).

Actions Taken to Tackle Sexual Violence in Alaska

The data examined in this research study were collected from 1996-2006. The substantial amount of data collected regarding sexual violence has provided valuable insight regarding the magnitude of the issue. Since the collection of data, an annual collaborative project between the University of Alaska at Anchorage Justice Center and the Council on Domestic Violence was designed to measure the prevalence of violence against women. The principal investigator on this project is André Rosay, who was also the principal investigator of the Alaska SANE data upon which this research study is based. Prior to these investigations, comprehensive statewide data were not available to guide planning and policy development in Alaska (Alaska Victimization Surveys). With the information from these surveys, the state is able to evaluate the impact of prevention and intervention services, provide greater support for preventing and responding to violence against women, and work to reduce the occurrence of violence against women (UAA Justice Center, 2013).

The Office for Victims of Crime developed the American Indian and Alaska Native Sexual Assault Nurse Examiner-Sexual Assault Response Team Initiative in 2010, which provided potential solutions to complex issues in order to improve the provision of coordinated community, victim-centered care. However, many barriers existed to the efforts to enhance and create new programs to address sexual violence. These barriers include a difficult-to-navigate maze of jurisdictional issues, the immense diversity of tribes, the lack of accurate, consistent data, and a general lack of resources. However, through efforts by the federal government and the Office for Victims of Crime, funding was provided to support the implementation of three SANE programs and the creation of a National Coordination Committee on the AI/AN SANE-SART Initiative to oversee development. It was intended that with these reinforcements, responses to victims of sexual violence could be improved through victim advocacy, law enforcement, and the criminal and tribal justice systems (Office for Victims of Crime, 2012).

The National Coordination Committee on the AI/AN SANE-SART Initiative submitted a report to the U.S. Attorney General in June 2014, a few years after the suggestions were made, which included issues and recommendations to the federal agency’s response to sexual violence in tribal nations (National Coordination Committee, 2014). Although the committee noted significant short-term improvements in policy and legislation had been made, they developed a set of concrete recommendations to improve efficiency and effectiveness of the federal system’s response to ensure long-term progress. The recommendations covered several critical areas; however, the ones applicable to this research included a policy change that required employees who performed investigative or victim assistance functions to be provided with a local, community-specific orientation on tribal customs and the unique challenges facing the particular tribal nation. Another policy required responders to sexual violence to facilitate the victim’s access to cultural, spiritual and ceremonial practices. For example, researchers discovered that many Native victims would prefer to take part in a cleansing or healing ritual following a sexual assault. Several times throughout the report the importance of properly educating and training workers on respecting culture and practicing in a culturally competent manner was noted, indicating movement in
a positive direction (National Coordination Committee, 2014).

**Purpose of the Study and Research Questions**

The purpose of this research study is to investigate disparities in behaviors and medical healthcare experienced by Alaska Native women who were sexually assaulted as compared to non-Hispanic white victims. More specifically, our research questions are:

1. How do Alaska Native and non-Hispanic white patients’ behaviors differ during medical examination?
2. How do Alaska Native and non-Hispanic white patients’ conditions during the assault differ? Condition refers to whether the victim was under the influence of drugs or alcohol at the time of assault.
3. Are there differences in time from assault to report between Alaska Native and non-Hispanic white women who have been sexually assaulted?
4. How likely are Alaska Native victims of sexual assault to be admitted to the hospital as compared to non-Hispanic white victims?
5. How likely are Alaska Native victims to experience injuries from the sexual assault as compared to non-Hispanic white victims?
6. Is the victim-suspect relationship difference between Alaska Native and non-Hispanic white women?

**Hypotheses**

Based on the review of the literature, the following hypotheses were posited, (1) Alaska Native patients behave differently from non-Hispanic white patients during medical examination, (2) Alaska Native patients are in a different condition as a result of drug and alcohol use than non-Hispanic white patients during the assault, (3) There are statistically significant differences in time from assault to report between Alaska Native and non-Hispanic white women who have been sexually assaulted, (4) Alaska Native victims of sexual assault are less likely to be admitted to the hospital compared to non-Hispanic white victims, (5) Alaska Native victims of sexual assaults are more likely to sustain injuries compared to non-Hispanic white victims, and (6) Victim-suspect relationships are different between Alaska Native and non-Hispanic white women.

**Methodology**

**Data Source and Sample**

The focus of our research is on female victims. Male victims were excluded due to a very small sample size represented in the surveys. We conducted a secondary data analysis using the Alaska Sexual Assault Nurse Examiner (SANE) Survey. The data for this study were collected from medical/forensic evaluations of sexual assault victims to provide supplemental information on sexual assault victimizations. The study examined the characteristics of sexual assault victimization in Alaska, as observed and recorded by sexual assault nurse examiners. The data included all SANE examinations conducted in Anchorage, Homer, Kodiak, Kotzebue, Nome, and Soldotna from 1996 to 2006. Data from a total of 1,383 examinations were collected and used in this research study. The majority (98%) of the victims are female. Over half (55%) of patients are Native; 35% are non-Hispanic white, and 8.7% are comprised of other race/ethnicities. Twenty percent of the patients are under the age of 18, 30% are 18 to 24 years of age, 23% are 25 to 34 years of age, 17% are 35 to 44 years of age, 10% are 45 years of age or older.

**Variables and Statistical Analysis**

This research was conducted after approval was received by the University of Arkansas Institutional Review Board. All variables pertaining to the aforementioned hypotheses as well as the demographic characteristics of the women are included in the SANE dataset.

The study contains 453 variables, although not all variables were not reviewed. We explored the demographic characteristics of victims, assault characteristics, post-assault characteristics, exam characteristics and findings, and suspect characteristics. Male respondents and respondents other than non-Hispanic whites and Alaska Natives were excluded from our analysis. Assault characteristics included information on the victim’s condition at the time of the assault (as a result of the victim’s use of drugs
or alcohol). Post-assault characteristics included information on post-assault actions taken by the victim and the time elapsed from the assault to the exam. Exam characteristics included information on the victim’s behavioral and emotional state during the exam, whether the woman needed emergency medical care and whether injuries were documented by medical staff. Injury characteristics included descriptions of both non-genital and anogenital injury. Injuries included bruising, redness, lacerations, swelling, fractures, and pain to various sites on the body.

The dataset is restricted. A description of the victims’ socio-demographic characteristics was completed by conducting univariate analysis (frequencies for categorical variables and descriptive statistics for continuous variables). To test the hypotheses a bivariate analysis was performed (chi-square test of independence) and a level of significance of alpha=0.05 was set to determine statistical significance.

Data

Behaviors during examination. The SANE nurses analyzed the woman’s behavior during the examination. Seventy-five percent of non-Hispanic white women were described as having controlled, composed behavior during the exam compared to roughly 50% of Alaska Native women. Approximately half of non-Hispanic white women were considered quiet as compared to 6 in 10 Alaska Native women who appeared quiet during their examination. Twice as many Alaska Native women compared to non-Hispanic white women were described as staring, with a fixed look, during the examination. Almost 15% of Alaska Native women were described as sleeping while less than 10% of non-Hispanic white women were described that way. Non-Hispanic white women were described as being more cooperative during the post-assault examination. Nine out of ten of non-Hispanic white women were considered cooperative as documented by the SANE nurses. Half of the Alaska Native women appeared tearful during the exam and 1 in 10 was described as sobbing. Close to four out of ten (38.94%) non-Hispanic white women were labeled as being tearful and less than 10% reported sobbing. Twice as many Alaska Native women were described as angry compared to the proportion of non-Hispanic white women.

Victim’s condition during assault. The SANE nurse documented the woman’s state or condition during the assault. Half of non-Hispanic white women victims claimed to have drunk alcohol compared to 83% of Alaska Native women. In addition, 50% of the non-Hispanic white women victims were alcohol intoxicated at assault compared with over 80% Alaska Native women at assault. Moreover, 16% of non-Hispanic white women noted using drugs compared to 10% of Alaska Native victims. Approximately 14% of non-Hispanic white women were drug intoxicated at the time of assault as compared to 7% of Alaska Native women. One-third of the non-Hispanic white women victims were sober at assault compared to approximately 10% of Alaska Native women victims. Finally, one-fifth of non-Hispanic white women victims were unconscious during the assault as a result of alcohol or drug ingestion compared to one-third of Alaska Native women.

Time from assault to report. Among women who had been sexually assaulted, Alaska Natives were twice as likely to report assault within two hours.
Table 2

Condition During Assault among Female Victims of Sexual Assault in Alaska

<table>
<thead>
<tr>
<th></th>
<th>Non-Hispanic White</th>
<th>Alaska Native</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count (%)</td>
<td>Count (%)</td>
<td>Count (%)</td>
</tr>
<tr>
<td>Patient's Use of Alcohol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>N=532</td>
<td>N=870</td>
<td>N=1402</td>
</tr>
<tr>
<td>No</td>
<td>196 (37)</td>
<td>122 (14)</td>
<td>318 (23)</td>
</tr>
<tr>
<td></td>
<td>x²(1)=123.305</td>
<td>p=0.000</td>
<td></td>
</tr>
<tr>
<td>Patient's Use of Drugs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>N=522</td>
<td>N=828</td>
<td>N=1350</td>
</tr>
<tr>
<td>No</td>
<td>81 (16)</td>
<td>83 (60)</td>
<td>164 (12)</td>
</tr>
<tr>
<td></td>
<td>x²(1)=15.9551</td>
<td>p=0.000</td>
<td></td>
</tr>
<tr>
<td>Alcohol Intoxicated at Assault</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>N=520</td>
<td>N=875</td>
<td>N=1395</td>
</tr>
<tr>
<td>No</td>
<td>239 (46)</td>
<td>189 (22)</td>
<td>428 (31)</td>
</tr>
<tr>
<td></td>
<td>x²(1)=91.0175</td>
<td>p=0.000</td>
<td></td>
</tr>
<tr>
<td>Drug Intoxicated at Assault</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>N=520</td>
<td>N=875</td>
<td>N=1395</td>
</tr>
<tr>
<td>No</td>
<td>449 (86)</td>
<td>813 (93)</td>
<td>1262 (90)</td>
</tr>
<tr>
<td></td>
<td>x²(1)=16.3139</td>
<td>p=0.000</td>
<td></td>
</tr>
<tr>
<td>Sober at Assault</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>N=520</td>
<td>N=875</td>
<td>N=1395</td>
</tr>
<tr>
<td>No</td>
<td>344 (66)</td>
<td>765 (87)</td>
<td>1109 (80)</td>
</tr>
<tr>
<td></td>
<td>x²(1)=90.5766</td>
<td>p=0.000</td>
<td></td>
</tr>
</tbody>
</table>

Note. Pearson chi-square and asymptotic significance (2-sided). For this test we use alpha of 0.05.

Table 3

Time from Assault to Report Among Female Victims of Sexual Assault in Alaska

<table>
<thead>
<tr>
<th></th>
<th>Non-Hispanic White</th>
<th>Alaska Native</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count (%)</td>
<td>Count (%)</td>
<td>Count (%)</td>
</tr>
<tr>
<td>Less than 2 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>N=580</td>
<td>N=922</td>
<td>N=1502</td>
</tr>
<tr>
<td>No</td>
<td>38 (7)</td>
<td>142 (15)</td>
<td>180 (12)</td>
</tr>
<tr>
<td></td>
<td>x²(1)=26.4344</td>
<td>p=0.000</td>
<td></td>
</tr>
<tr>
<td>1-3 days</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>N=580</td>
<td>N=922</td>
<td>N=1502</td>
</tr>
<tr>
<td>No</td>
<td>122 (21)</td>
<td>125 (14)</td>
<td>247 (16)</td>
</tr>
<tr>
<td></td>
<td>x²(1)=14.4858</td>
<td>p=0.000</td>
<td></td>
</tr>
</tbody>
</table>

Note. Pearson chi-square and asymptotic significance (2-sided). For this test we use alpha of 0.05.

Table 4

Injuries Sustained from Assault Among Female Victims of Sexual Assault in Alaska

<table>
<thead>
<tr>
<th></th>
<th>Non-Hispanic White</th>
<th>Alaska Native</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count (%)</td>
<td>Count (%)</td>
<td>Count (%)</td>
</tr>
<tr>
<td>Non-genital trauma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>N=512</td>
<td>N=825</td>
<td>N=1337</td>
</tr>
<tr>
<td>No</td>
<td>286 (56)</td>
<td>341 (41)</td>
<td>627 (47)</td>
</tr>
<tr>
<td></td>
<td>x²(1)=26.7685</td>
<td>p=0.000</td>
<td></td>
</tr>
<tr>
<td>Anogenital trauma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>N=504</td>
<td>N=811</td>
<td>N=1315</td>
</tr>
<tr>
<td>No</td>
<td>193 (38)</td>
<td>353 (44)</td>
<td>546 (42)</td>
</tr>
<tr>
<td></td>
<td>x²(1)=3.5054</td>
<td>p=0.061</td>
<td></td>
</tr>
</tbody>
</table>

Note. Pearson chi-square and asymptotic significance (2-sided). For this test we use alpha of 0.05.

compared to non-Hispanic white women victims. In contrast, 20% of non-Hispanic white women are likely to report within 1-3 days as opposed to approximately 10% of Alaska Native women.

Admitted to hospital. In most instances, SANE examinations were conducted off-site, for example, at a multidisciplinary center. If it was determined that the victim needed additional medical assistance, they were transferred to the hospital or emergency room. There was no statistically significant difference found between the number of non-Hispanic white women who were admitted to the hospital following sexual assault compared to the number of Alaska Native women. Overall the number of women who were admitted to either the hospital or emergency room following an assault is too small of an amount to report in order to protect confidentiality.

Injuries sustained from assault. Alaska Native women are more likely to sustain both non-genital and anogenital trauma than non-Hispanic white women. Of the non-Hispanic white women victims, 44% sustained non-genital trauma and 38% had anogenital trauma. Six in 10 Alaska Native women suffered non-genital trauma and almost half of them experienced anogenital trauma.

 Victim-suspect relationship. The most statistically significant piece of data from this section can be found in the victim-suspect relationship in
which the attacker was a relative. One in 10 Alaska Native victims of sexual violence are assaulted by one of their relatives. This is significant compared to the small number of non-Hispanic white women who are assaulted by a relative. The other variables in this dataset provide valuable evidence in helping to determine the most prevalent victim-suspect relationships. For example, 40% of non-Hispanic white women and 36% of Alaska Native women suffered an attack in which the suspect was a friend/acquaintance known by the victim for over 24 hours. Less than two out of ten (17.5%) of non-Hispanic white women and 21% of Alaska Native women suffered an attack in which the suspect was an acquaintance the victim had known for less than 12 hours. Finally, 16% of non-Hispanic white women and 15% of Alaska Native women suffered from an attack in which the suspect was a stranger.

Table 5
Victim-Suspect Relationships Among Female Victims of Sexual Assault in Alaska

<table>
<thead>
<tr>
<th></th>
<th>Non-Hispanic White</th>
<th>Alaska Native</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=537</td>
<td>N=870</td>
<td>N=1407</td>
</tr>
<tr>
<td><strong>Friend/ Acquaintance</strong> (24+hrs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>217 (40)</td>
<td>314 (36)</td>
<td>531 (38)</td>
</tr>
<tr>
<td>No</td>
<td>321 (60)</td>
<td>556 (64)</td>
<td>876 (62)</td>
</tr>
<tr>
<td>x2 (1)=2.6345</td>
<td></td>
<td></td>
<td>p=0.105</td>
</tr>
<tr>
<td>Acquaintance (&lt;12hrs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>94 (18)</td>
<td>185 (21)</td>
<td>279 (20)</td>
</tr>
<tr>
<td>No</td>
<td>443 (83)</td>
<td>685 (79)</td>
<td>1128 (80)</td>
</tr>
<tr>
<td>x2 (1)=2.9525</td>
<td></td>
<td></td>
<td>p=0.086</td>
</tr>
<tr>
<td><strong>Relative</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>&lt;10%**</td>
<td>83 (10)</td>
<td>97 (7)</td>
</tr>
<tr>
<td>No</td>
<td>523 (97)</td>
<td>787 (90)</td>
<td>1310 (93)</td>
</tr>
<tr>
<td>x2 (1)=24.8660</td>
<td></td>
<td></td>
<td>p=0.000</td>
</tr>
<tr>
<td><strong>Stranger</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>88 (16)</td>
<td>132 (15)</td>
<td>220 (16)</td>
</tr>
<tr>
<td>No</td>
<td>449 (84)</td>
<td>738 (85)</td>
<td>1187 (84)</td>
</tr>
<tr>
<td>x2 (1)=0.3715</td>
<td></td>
<td></td>
<td>p=0.542</td>
</tr>
</tbody>
</table>

Note. Pearson chi-square and asymptotic significance (2-sided). For this test we use alpha of 0.05.

**Exact proportions cannot be reported due to confidentiality which the attacker was a relative. One in 10 Alaska Native victims of sexual violence are assaulted by one of their relatives. This is significant compared to the small number of non-Hispanic white women who are assaulted by a relative. The other variables in this dataset provide valuable evidence in helping to determine the most prevalent victim-suspect relationships. For example, 40% of non-Hispanic white women and 36% of Alaska Native women suffered an attack in which the suspect was a friend/acquaintance known by the victim for over 24 hours. Less than two out of ten (17.5%) of non-Hispanic white women and 21% of Alaska Native women suffered an attack in which the suspect was an acquaintance the victim had known for less than 12 hours. Finally, 16% of non-Hispanic white women and 15% of Alaska Native women suffered from an attack in which the suspect was a stranger.

Discussion

Analyzing the documented behaviors of Native Alaskan and non-Hispanic white women during the post-assault examination revealed interesting results. For example, the majority of Native Alaskan women were considered less cooperative, less controlled, and more tearful in comparison to non-Hispanic white women. Alaska Natives have unique demographic, historic and healthcare delivery characteristics that play a role in their perspectives and demeanor (Parker et al., 2002). Being documented as quieter or less cooperative could be attributed to a lack of trust with the healthcare system and/or healthcare providers. Many native researchers and healthcare providers recognize that there is a lack of cultural competency and issues of trust and power present as challenges (Goodkind et al., 2010).

Telling results in the data regarding victim’s condition during assault help shed light on a major issue in Native Alaskan culture not previously mentioned heavily in detail, but carrying its own negative consequences. Alcohol abuse, alcohol dependence and binge drinking are common among the Alaska Native population and are associated with high levels of violence (Seale, Shellenberger, & Spence, 2006). Experts often link the high rates of sexual assault with the high rates of alcohol and drug abuse. One local advocate says “It’s putting a Band-Aid on the hurt… That’s why there’s so much rape. They don’t feel good, they black out, and alcohol and drugs cover the pain” (Bernard, 2014, p.11). Alcohol and drugs can be unhealthy coping mechanisms for individuals who have suffered a traumatic experience. In the sample, eight out of ten Alaska Native women victims reported using alcohol and being alcohol intoxicated during the assault. The overuse of alcohol is a major health issue and a substantial risk factor for increased sexual violence. Alcohol and drug abuse have both short and long-term negatives effects, such as: impaired judgment, decreased perception, impaired decision making, as well as livery and kidney disease (National Health and Medical Research Council, 2009).

When examining the time from assault to report, more Alaska Native women immediately reported the incidence than non-Hispanic white women. Historically, silence has been the norm and violence is almost expected, but in recent years a few Alaskans have begun to speak publicly about the issue of sexual violence. In fact, a prevention initiative called Alaska Men Choose Respect was launched in 2009 and it uses a combination of pervasive public service announcements, annual rallies, and other incentives, such as increased sentencing for sex offenders, to discourage victims from suffering in silence (Bernard, 2014). Although the Alaska Native women were more...
likely to report within the first two hours, the number of Alaska Native and non-Hispanic white women to immediately report the incident were small. These results suggest the need for additional public education and support programs to encourage victims to seek assistance in the event of an assault. The earlier victims are able to report, the more accurate the evidence is and steps taken to promote healing and reduce trauma can begin.

As mentioned briefly in the results section, women seeking treatment from SANEs arrive at various designated locations, including a multidisciplinary center. If it is decided that the victim needs further medical assistance that cannot be provided in the current setting, they are transferred and admitted to either the hospital or emergency department. Although there were not significant differences for admittance between non-Hispanic white and Alaska Native women, it is interesting to note that the numbers for hospital and emergency department admittance are overall very low. This fact could support the effectiveness of SANE programs in providing necessary, post-assault care, although further research is needed. Before the start of the SANE/SART protocol, victims who needed medical care were referred to the emergency department where they would wait for several hours before being treated. Sexual assault nurse examiners are able to treat the majority of victims in a timely manner. The installation of SANE/SART programs have led to significantly better responses to sexual violence, by providing a triage for sexual assaults so that the emergency department now only deals with the most physically severe cases (Rosay & Henry, 2007).

The results of our study indicate that in comparison to non-Hispanic white women victims, Alaska Native women victims are more likely to experience physical trauma from the assault and are significantly more likely to have been attacked by a relative. Alaska Natives suffer domestic violence and physical assault at rates far exceeding women of other ethnic groups (Bachman et al., 2008). For example, 60% of AI/AN women reported being physically assaulted in their lifetime as opposed to 50% of women overall. In addition, the prevalence of intimate partner violence (IPV) for AI/ANs ranges from 50-90% as compared to the prevalence of IPV in non-Native women, which ranges from 5-50% (Oetzel & Duran, 2004).

There are unique challenges that face Alaska Native women. The research questions and variables analyzed in this study show that Alaska Native women victims of sexual violence are diverse from the non-Hispanic white women victims and indicate a need to provide care that is unique and culturally sensitive.

**Conclusion and Policy Implications**

“Sexual abuse ends when we begin to talk” (Sutter, 2014, p.2).

The ongoing problem of sexual violence in Alaska is high on the list of major national social justice issues. As stated previously, the rate of sexual violence in Alaska is great. Almost one in four women in Alaska are raped or sexually assaulted and almost one in six are victims of intimate partner and/or sexual violence (Sutter, 2014). The process to begin addressing this problem started by investigating previous research involving the issue. This research was conducted due to an evident lack of information available, specifically regarding the cultural aspect of sexual violence in Alaska and the health care disparities between Alaska Native and non-Hispanic white women victims. Preliminary research indicated, “accurate, comprehensive, and current information…is critically needed to improve understanding…and to educate and inform policymakers and the public” (Crossland et al., 2013, p.786).

Comparing multiple variables related to sexual assault of Native Alaskan women and non-Hispanic white women victims showed obvious notable differences that warrant recognition. The behaviors of the women during the examination were significantly different. The Native Alaskan women were described as less controlled, less cooperative, and less likely to be sober at the time of the assault. In addition, the Native Alaskan women suffered more physically traumatic assaults that led to more emergency department admittances. In many aspects Native Alaskan women are different from non-Hispanic white women in terms of their behaviors, reactions to trauma, preferred treatments and interventions, relationships with their attacker, family dynamics and cultural practices. Overall, we conclude from these results that the differences between the two groups show a need for more culturally tailored examination components, interventions and treatments post-assault for Alaska Native women victims of sexual violence.

Cultural competence is inarguably a vital part of treating and caring for any patient population. There has been progress made at the federal level to address
cultural competence nationwide. In 2000 the United States Department of Health and Human Services Office of Minority Health released national standards for culturally and linguistically appropriate services (CLAS) in an effort to eliminate healthcare disparities (Lehman et al., 2012). More recently, and specifically related to the current sexual violence epidemic, in 2010 The Office for Victims of Crime developed the American Indian and Alaska Native Sexual Assault Nurse Examiner-Sexual Assault Response Team Initiative providing a potential solution that focused on coordinated community, victim-centered care (Office for Victims of Crime, 2012).

However, the most recent update regarding this issue at the government-level was a report to the U.S. Attorney General from the National Coordination Committee on the AI/AN SANE-SART Initiative in 2014. The report states that although there have been improvements, there is still much more to be done in terms of coordination and collaboration at the local level, Department of Justice personnel policy changes and funding, and public health and safety (National Coordination Committee, 2014).

Fortunately, there has been progress made in terms of policy, initiatives and governmental actions, but a problem that has amassed over several decades demands solutions from multiple angles to prove effective. Analyzing the current situation and progress, this research supports the need for recommendations to help reduce health disparities within the sexually assaulted Alaska Native women population. Recommendations include (1) requiring the incorporation of cultural competency training in the preparation curriculum for sexual assault nurse examiners (SANEs) working with the Alaska Native population, and (2) collaborating with the National Alaska Native American Indian Nurses Association in SANE training.

Experiencing rape or sexual assault is a traumatic experience; thus it is vital that sexual assault nurse examiners develop rapport with the victims they treat. Learning new skills and techniques related to culturally competent practice and having an accurate understanding of the Alaska Native culture is necessary in order for SANEs to connect with victims and provide equal, high-quality care. Cultural competency training curriculum to prepare SANEs for working with the Alaska Native population would include: education on Alaska Native family dynamics, the role and behaviors of women, traditional cultural healing practices and preferred methods of accessing healthcare. Campinha-Bacote’s model titled “The Process of Cultural Competence in the Delivery of Healthcare Services” could be instituted to help guide SANEs as they work to develop their individual cultural knowledge, identify barriers, and assess and respond to the differences present in Native Alaskan culture (Campinha-Bacote, 2002, p. 184).

The National Alaska Native American Indian Nurses Association is a valuable agency and there are many potential benefits available through collaboration. The AI/AN nurses are more likely to work in native communities than healthcare providers of other ethnic groups and have the capacity to improve health and wellness in these populations (Parker et al., 2002). However, a challenge facing the NANAINA is that the highest level of education for the majority of AI/AN nurses is an associate’s degree. Without a bachelor’s degree, nurses are unable to organize, plan, initiate, implement and evaluate community-level programs and they are also unable to become sexual assault nurse examiners (Parker et al., 2002). NANAINA, the local, state and federal governments, and current SANEs could collaborate and form an interdisciplinary network ready to tackle the sexual violence issue against Native Alaskan women in culturally sensitive ways. The government could assist in finding means for NANAINA nurses to achieve baccalaureate degrees and to assist them in training to become SANEs: providing access to online BSN programs, assistance with funding, and availability of SANE trainers. In exchange, the NANAINA could be a valuable mediator between native communities and healthcare providers. The NANAINA nurses could provide experiential knowledge about Alaskan culture and educate SANEs of other ethnicities on how to best respect the tradition and values of the patients they will be treating.

There was an extensive investigation of the available literature prior to beginning this research. Previous research findings were unanimous in concluding that sexual violence in Alaska was a major issue. They were also in agreement on the fact that there is a drastic need for more information regarding the cultural disparities affecting Alaska Native women. This research has begun to fill that gap.

Comparing the variables in the data collection produced some expected results and others were more surprising, but overall the results pointed to one major
theme: Alaska Native women are different than non-Hispanic white women. These women need to be treated by healthcare providers who understand them: their reactions, situation, and their culture. Not only have the Alaska Native women who come in to be treated by SANEs been victims of a traumatic sexual assault, they are also victims of healthcare disparities. This research has highlighted that there is a pressing need to include cultural competence in SANE education curriculum. Alaska Native women deserve quality, culturally sensitive, and holistic care centered around maintaining their dignity and respecting their wishes.

The implications for this research do not stop here. By answering the call to present evidence indicating disparities in care, now is the time to act. As stated in the beginning of this section, “sexual abuse ends when we begin to talk” (Sutter, 2014, p.1). The government, NANAINA, and the sexual assault nurse examiners need to collaborate in order to start developing solutions to the issue of health disparities in the care of Alaska Native women victims of sexual violence.

**Study Limitations**

A limitation of this study is that the demographic of the sexual assault nurse examiners was undocumented. Therefore, there is no way to know whether the documenting SANE had an adequate understanding of Alaska Native culture: behavioral norms, and typical cultural responses to trauma. Culture affects behavior. If the sexual assault nurse examiner is unfamiliar with an individual’s cultural behavior, there is the risk of misinterpretation when judging a patient’s reaction.

Other difficulties pertain to conducting secondary data analysis of variables available in the survey. Other important factors, including education level, marital status, income level, and insurance coverage that could have explained the disparities observed in the victims’ behaviors, post-assault attitudes, and care received could not be investigated. In addition, the data reflect sexual assault victims who presented for post-assault care and were treated by a SANE, and thus the findings of this study are not generalizable to survivors who sought care at a health care facility without SANEs. Furthermore, since the data were not weighted, our results cannot be extrapolated to the population of sexual assault victims living in cities other than those considered in the survey.

This research analysis was based on a 10-year-period; however, the years were aggregated to protect the confidentiality of the victims. Similarly, although the study was conducted in Anchorage, Kotzebue, Nome, Kodiak, Kotzebue, and Soldotna, information on the actual location of respondents was not provided to protect their confidentiality. We were therefore not able to establish causality, or ascertain the prevalence of sexual assaults based on the city of residence. Despite these limitations, the findings can be used to update the protocol for Sexual Assault Medical Forensic Examinations and to properly educate sexual assault nurse examiners so they are readily equipped to provide more equitable, culturally competent care with the hope that a better concordance in patient-provider relationship would encourage victimized women to refrain from suffering in silence.

**References**


As a newly-emerging, sustainable approach to landscape management, permaculture seeks to integrate knowledge from several disciplines into a holistic system with emphasis on ecological and social responsibility. Online resources on permaculture appear to represent a promising direction in the movement by supplementing existing printed sources, serving to update and diversify existing content, and increasing access to permaculture information and praxis among the general public. This study evaluated a sample of online resources on permaculture using a framework of parameters reflecting website usability and content quality. Best practice for website usability, as well as diversity of information and applicability, was addressed. The evaluation revealed, overall, good quality and usability in the majority of cases, and suggests a strong online presence among the existing permaculture community, and accessible support for those with an interest in joining the movement.

Keywords: Online permaculture resources, evaluation framework

Research Background

Permaculture: Definitions and Origins

Permaculture is a system of guiding principles and ethics for sustainable food production and land management, developed by Bill Mollison and David Holmgren in the 1970s; the term permaculture was derived from “permanent” and “agriculture,” as well as “permanent culture” (Mollison, 1994, p. 1). The concept of permanence refers to the sustainability aspect of the approach, in contrast with conventional agriculture (Bane, 2012, pp. 8-9). The goal is to create beneficial, symbiotic relationships among system components such as energy, animals, buildings and plants. Leading permaculture experts tend to emphasize different principles and applications, yet there are connecting threads, primarily in the following ethics of the system: “care of the earth,” “care of people,” and re-investment of surplus resources to those ends (Mollison, 1994, p. 3).

Permaculture does not fit into any single academic field and is not generally taught at universities. Therefore, exchange of knowledge and methods has primarily been carried out through trained instructors and, more recently, the web and social media. Such interaction is essential, because permaculture is often unintuitive to beginners and is not easily replicated from one site or context to another. There are a number of guiding principles embedded within permaculture ethics, and these vary in emphasis from practitioner to practitioner. However, for the sake of simplicity, Mollison (1994) posits that there are nine basic principles: Table 1 highlights these principles.

The overall focus of principles across all versions and practitioners is to rely on observation and natural pattern recognition, resource cycling, multi-function inputs, planting perennials, and accelerating succession. The applications and methods in permaculture are not new in themselves; in some places, permaculture is just as likely about preserving or restoring indigenous practices.

Permaculture: Implementation of the Idea

Permaculture is capable of addressing key sustainability issues in the world by allowing communities and individuals to take ownership of enormously complex issues such as food security, climate change, soil erosion, and desertification, and by addressing them at a local scale. Because community members take part instead of relying on external aid and planning, they develop ownership in the project and are often highly motivated, leading to successful
outcomes. Successful practices are then transferable to nearby villages and neighborhoods, often through demonstration and education sites.

Although mainstream media has largely discounted the permaculture movement, some journalists have begun to take notice. For example a recent story highlighting its application for Malawian flood control and food security appeared in the United Kingdom’s The Guardian newspaper in April 2015 (Moorsom, 2015). Below are just three international examples of implemented permaculture projects that highlight the global reach and diversity of this emerging movement.

**Suvaraga Aguyt Cooperative, Mongolia.**
Suvaraga Aguyt is a small cooperative with modest aims to attain food security and to adapt to climate change. At the heart of this project is creative design. An experienced design team working along with the cooperative leaders had a variety of specific issues to tackle, such as a short growing season, preparing for (climate-change driven) deep-freeze scenarios in the future, identifying low-cost inputs, and planning for the collection and storage of resources (e.g., sunlight and water). The design team received feedback from the cooperative’s leaders about existing practices and challenges on-site. Along with the local trainees, participants in a Permaculture Design Course (PDC) were then able to implement effective solutions. In his explanation that follow-up can be conducted by means of email communications, Rick Coleman, the lead PDC instructor states: “We leave behind an empowered group to design their own solutions. Permaculture is information and imagination-intensive, lending itself to be followed up even from a distance, by email or internet” (Lynch, 2014, p. 119).

There is nothing traditional about Mongolians growing lettuce or potatoes, but with the wide variations in temperature, alternative solutions are required. Between 1999 and 2002, local herds suffered losses of over eleven million cattle due to extreme, unusually cold winters (Lynch, 2014). Subsequently, many people have left the countryside for the capital, leaving food production to a small percentage of remaining farmers. Exported vegetables from China and Russia are available for sale, but those often arrive with varying degrees of spoil (Lynch, 2014). Subsequently, working with succession, Accommodation of plant succession to create healthy soil and vegetative communities.

<table>
<thead>
<tr>
<th>Principles of permaculture</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative location</td>
<td>The pattern of spatial relationships that dictate the best relative location for all inorganic (such as buildings and structures) and organic (such as shade trees and crops).</td>
</tr>
<tr>
<td>Multiple purpose</td>
<td>Each element should provide multiple benefits for the site – for example, trees should be selected and located to provide shade, fruit, erosion control and mulch.</td>
</tr>
<tr>
<td>Complementary solutions</td>
<td>Essential needs (food, water, energy) are served by the design in multiple ways.</td>
</tr>
<tr>
<td>Zone planning</td>
<td>Elements are laid out in an efficient manner, following patterns of most-frequent use.</td>
</tr>
<tr>
<td>Biological resources are preferred</td>
<td>Fossil fuels and derived products are minimized to unavoidable essentials.</td>
</tr>
<tr>
<td>Re-use</td>
<td>Energy and resources should be re-used wherever possible.</td>
</tr>
<tr>
<td>Efficiency of cultivation</td>
<td>Intensive cultivation of the smallest possible area, very efficient and controlled implementation.</td>
</tr>
<tr>
<td>Working with succession</td>
<td>Accommodation of plant succession to create healthy soil and vegetative communities.</td>
</tr>
<tr>
<td>Edge effects</td>
<td>Use natural or built boundaries to maximize bio-diversity and productivity.</td>
</tr>
</tbody>
</table>

Table 1. The nine principles of permaculture (Mollison, 1994, pp. 6-26).
Challenging cultural norms is sometimes part of the creative design process, and here in Mongolia one of the tasks is finding acceptable ways to integrate sewage while utilizing it as a renewable resource. In another cultural setting, a system of humanure (a more direct way to compost) would cycle these resources. But here, to strike a compromise, a system of temporary pits achieves waste disposal, and fruit trees are planted once each pit reaches capacity. Some aspects remain a challenge. Retrofitting abandoned buildings into greenhouse space takes time and finances, and building a seed bank of best fruit varieties also takes time. As the community becomes more successful, earning an income from the sale of produce surplus will help fund additional phases of the project, however, engaging and educating the community has been a gradual process (Lynch, 2014).

Maya Mountain Research Farm, Belize. A more established site of applied permaculture is located in the Maya Mountain Research Farm (MMRF) in Belize, which serves as a valuable example of successful land restoration in the tropics. MMRF is located at the site of an ancient Mayan city, near the Columbia Forest Reserve; it borders a well-known archaeological site. The farm is a popular training destination for a Permaculture Design Course, and features prominent experts in permaculture (Bates, 2014; Moore, 2013). At the time of its purchase by the current owner in 1988, the land was a conventional-style citrus and cattle farm; it now functions as a non-profit enterprise and a research center. The site has a number of species that is nearly overwhelming, not only in terms of various trees and plant types such as vanilla, cacao, coconut, guava, and avocado, but also in the number of varieties of each. After years of work in reforestation and achieving biodiversity, the system has reached maturity and its upkeep is largely low-maintenance, while providing most of the resources needed at the farm. The abundance of trees on site not only provides edible crops and timber, but also captures carbon dioxide, a benefit extending beyond the farm site to the larger, global community. The farm also engages in giving back to the community by donating its food surplus to a local nutritional program for the elderly (Moore, 2013, pp. 28-30).

MMRF serves as an education and demonstration center that trains “locals, Peace Corps volunteers, government agriculture researchers, and international students” (Bates, 2014, p. 51). The farm is very active in seed exchange programs with local farmers, and considers this essential to its function in local food security and biodiversity awareness. Both cacao and vanilla are important crops at MMRF; the farm boasts “a gene bank of 250 indigenous vanilla vines” (Bates, 2014, p. 51). As in any permaculture site, most resources on site find multiple uses; for instance, cacao pods are recycled as biochar once seeds are separated from the pod.

While teaching permaculture methods, education efforts at MMRF also aim to help reverse loss of indigenous knowledge of agroforestry, a legacy of the ancient Mayan civilization. These almost-forgotten methods are endangered because they have largely been replaced with conventional crop farming. Many neighboring farms practice conventional agriculture; as part of the annual field-burn practices, an uncontrolled nearby fire in 2008 destroyed a large part of the managed forest system at MMRF. The sections still recovering are considered ‘works in progress’, now densely planted with many various plants including timber, nitrogen-fixing plants, biomass accumulators and pioneer species to address erosion and to help speed the recovery of land to health (Bates, 2014).

Krameterhof, Austria. One of the most well-known and recognized projects in permaculture began in the 1960s in Austria, and has grown to a size of 45 hectares (Holzer, 2011). At 1,000-1,500 m (~3200 - 4900 ft.) above sea level, several challenges such as controlling erosion, a short growing season, and temperature fluctuations need consideration. In order to control temperature, windbreaks, raised beds, stones to retain heat, and terracing techniques have all been effective in this regard. Besides helping control erosion, terracing, ponds, and other earthworks also help retain water on site to percolate down rather than create runoff (Holzer, 2011).

Trees and plants thrive in every corner of the farm. With experimentation, Holzer has been able to grow unlikely varieties, especially given the challenging site (2011). He is also fond of heirloom varieties, as these tolerate difficult and variable site conditions. In addition, heirloom edibles are often better in flavor. There are multiple cereal crops grown at Krameterhof, including ancient wheat and spelt. Tree orchards and even forest areas contain a few thousand fruit tree varieties including pears, apples, cherries, and also
wild varieties, which helps maintain a healthy system. Natural materials are recycled on site, for example trees damaged in a storm are converted into shelter material for the animals, terracing structures for the garden or for raised beds (Holzer, 2011).

A large variety of animals are also part of the farm homestead. Holzer considers his farm animals to be workers who are largely free to roam the site (2011). While the animals are provided with shelters on site, they are not confined. Given some proper encouragement through feed placement, pigs turn the soil over for management and new planting; this is especially useful with stony soils. The farm holds heirloom pig varieties, has experimented successfully with wild cattle (yaks, bison), cows, and poultry (ducks, geese, and at times even pheasants and quail; Holzer, 2011). These kinds of successes have been the result of trial and error, and observation over time. Every aspect, from soil quality and plant pollination to managing inputs sustainably requires attention to learn what works and what does not.

While holding an on-site workshop in 1995, the owner learned that the methods utilized at his farm were very similar to permaculture (Holzer, 2011). Holzer is now teaching within the framework of permaculture as no other system matches this style of farming closely, apart from agroforestry applications with the related sections at the site. At the urging of others, Holzer decided to open up the farm to visitors and to hold public tours and training events in order to share success stories. Since then, information about the farm and its methods have also become available in several DVDs, books, and online. Krameterhof is an illustration of permaculture methods straddling new and old practices in land management and farming. It is where traditional knowledge systems - rejected or lost-become useful once again, regardless of whether the term “permaculture” is specifically applied.

Accessing Permaculture Resources: Internet & Social Media

The three case-studies presented above demonstrate not just the international dimension of permaculture, but also highlight that the implementation is challenging and deals with fundamental survival and quality of life issues. This suggests the permaculture community can greatly benefit from inter-community advice, guidance and discussion. Permaculture projects are highly “information-intensive” (Mollison, 1994, p. 31) and so access to information, advice and case studies is very important, especially in the design and early management stages until a healthy and well-functioning ecosystem is established. Increasingly, in general readers seek information and solutions in an online environment (Waller, 2011) and permaculture projects like those presented above are more extensively documented in blogs, social media, and online video updates, than in print.

A study by Ferguson and Lovell (2014) identified just 230 traditional, academic-type publications on permaculture, including books, periodicals, conference proceedings, and graduate theses. While scientific literature on permaculture has recently increased, and numerous opportunities for academic investigation remain (Ferguson & Lovell, 2014), the Internet is often a more immediate resource of information about permaculture for the layman and, unlike printed sources, provides opportunities for interaction. For example a recent article reports on an established project in the Outer Hebrides, off the coast of Scotland, and recounts early frustrations felt by the land-owners as they attempted to kick-start their project in the 1970s, “a time before the Internet,” with little opportunity to learn from others’ experiences in a similar, challenging climate zone (Lauruol, 2014, p. 42).

Given the complexities, challenges, community focus, and global dimension of permaculture, there seems to be a good fit with online resource provision, especially case-studies and guidance. Several efforts have already been made to document global case studies in hard-copy format (Bane, 2012; Birnbaum, 2014; Holmgren, 2005). However, informal, web-based resources are also worth examining for the following reasons: their potential convenience and ease of access to the layman community; fast cross-referencing of information and sources (comparison “shopping”); and the opportunity for interactive learning (forums and social media). At first glance, the online permaculture community appears quite diverse; some webpages and videos are devoted to telling the story of an individual project (such as a blog), while others combine background information and principles overview with practical advice and techniques. Podcasts and online forums are also available, and projects with a Facebook page generally feature photos and progress updates. These resources are generated by a great variety of groups and individuals worldwide, including NGOs,
local communities, and well-known experts in the field.

Research Objectives and Limitations

The potential for online permaculture resources is not limited to urban and developed world communities. One notable blog post from the Permaculture Research Institute (PRI) Kenya website lists a request from a local permaculture farm to donate a laptop and camera for documenting their on-site progress with project implementation (Brush, 2010). However, the dissemination of appropriate technology and information platforms in less developed or urbanized locations may be more limited; this is partly addressed in this article. More broadly, there appears to have been little attention given to the quality and accessibility of online permaculture advice and information, as a complement to the aforementioned work available in print form. Beginning to close this gap in knowledge is the overall aim of this work.

For the purposes of this study, specific research objectives are to (a) create evaluative criteria for online permaculture resources and (b) apply these criteria to a non-representative sample of case-study web-sites and online resources to tentatively identify trends in quality. It should be noted that this study was subject to narrow time-limits and, as such, cannot claim to be an exhaustive survey. The case sites of online permaculture resources presented here are not representative and therefore research findings can only be tentative. In addition, web-based resources are dynamic and the study was limited to a brief timespan. It should also be noted that the Internet is not accessible to all, and the knowledge and methods shared online are often communicated ‘second-hand’ to “Internet-free” or low-availability zones through aid organizations (i.e. NGOs, non-profits) and practitioners who travel to teach or volunteer. Therefore, assessing the quality of this information transfer is beyond the scope of this paper.

According to Barton and Kleiner (2000), evaluation of sustainable case studies must be treated with caution, since it involves a level of simplification and subjectivity; however it can be sharpened and objectified through reference to best practice. In this paper, best practice has been described in the Methods section, while the literature review provides the background for those metrics dealing with qualitative evaluations.

Research Methods

Online Case-Site Selection Criteria

The sample of online resources includes a diverse mix of projects in different climates and world regions. High-income countries (i.e. developed nations) are represented along with lower-income countries (i.e., lesser-developed nations). The sample includes different types of organizations by structure and funding sources, such as community, NGO (Non-Governmental Organization), private, and BOT (Build Operate Transfer). A BOT is initially a privately owned project that is transferred to the government after an agreed-upon period of time (Huijbregts, 1996). Websites operated by experts and leading figures in permaculture and prominent periodicals on permaculture are included in this study, as well as small, lesser-known individual farm and community projects. In some instances, two websites with the same owner but two separate web addresses were evaluated as a single case study due to large sections of indivisibly-shared content and their complementary function. Diverse geographic regions and climates are also represented. A more complete representation is limited by the scope of this study and the case sites presented here are, of course, not exhaustive. However, the intention here was to present a diverse range of web-based resources within the limited time of the study. The following sub-sections outline the evaluative criteria compiled to assess the case-sites of online permaculture resources, largely drawn from reported best-practice. Tables 2A and 2B below summarize the evaluative criteria for quick reference.

Usability: Layout and Style

Even with high quality content, visitors will find a website to be less than helpful if it provides poor usability experience. Usability experts Jakob Nielsen and Kara Pernice (2010) share results of their research on how visual elements in layout can strongly affect a web user’s experience, including alienating frustrated users. Generally with regard to layout, web design experts advise to keep things simple: uncluttered with sufficient white space, also known as “breathing space” (Lopuck, 2012, p. 123), along with distinct page sections to group content - this helps create a visual hierarchy and prioritize content for the reader (Krug, 2014; Lopuck,
Table 2A. Numeric Evaluation Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rationale for evaluation</th>
<th>Rubric of numeric evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 – Very Poor</td>
</tr>
<tr>
<td>Usability: layout and style</td>
<td>Affects ease of use. Includes: page organization; spacing, use of headings and subheadings; selection of color and style in background and fonts all to be unified through design to present content effectively.</td>
<td>Scattered design, no evidence of strategy in visual presentation</td>
</tr>
<tr>
<td>Usability: navigation</td>
<td>Affects efficiency of communication and access to content. Includes: placement of navigational elements and their persistence throughout website; section labeling and organization.</td>
<td>Unclear section labeling, very poorly organized placement</td>
</tr>
<tr>
<td>Usability: search feature</td>
<td>Affects ease of access to information. Includes: placement and function of the search feature throughout the website.</td>
<td>Inconsistent placement, or poor function</td>
</tr>
<tr>
<td>Content updates</td>
<td>Affects relevance of information. Includes: time elapsed since the last content update.</td>
<td>No apparent updates in over 2 years</td>
</tr>
<tr>
<td>Resources and links</td>
<td>Affects ease of access to additional information. Includes: presence of materials, drawings, documents, podcasts, videos, and linked resources.</td>
<td>Very few or poor in quality materials, bad links</td>
</tr>
<tr>
<td>Problem-solving</td>
<td>Affects implementation and dissemination of best practice. Includes: problem-solving content for do-it-yourself projects; offering PDC or referrals.</td>
<td>Almost no content related to problem-solving</td>
</tr>
<tr>
<td>Financial discussion</td>
<td>Affects feasibility of implementation. Includes: articles or forum posts on topics related to financing a project,</td>
<td>Very little content, or only marginally</td>
</tr>
</tbody>
</table>

Table 2B. Non-Numeric Evaluation Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rationale for evaluation</th>
<th>Forus included (F)</th>
<th>Social media links provided (S)</th>
<th>Comments allowed (Cm)</th>
<th>Global scope in case-studies (G)</th>
<th>Regional scope in case-studies (R)</th>
<th>Local scope in case-studies through a single project (L(s))</th>
<th>Local scope in case-studies through various projects (L(v))</th>
<th>Non-Governmental Org. (NGO)</th>
<th>Private w/ additional Funds (PA)</th>
<th>Non-Profit Org. (NP)</th>
<th>Build-Operate-Transfer (BOT)</th>
<th>Community (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interactive features</td>
<td>Affects dissemination of knowledge. Includes Presence of forums, social media links, and ability to view and post comments on website.</td>
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<tr>
<td>Inclusion of case-studies</td>
<td>Affects understanding of implementation and context of projects. Includes: Description of physical site projects, including photos, progress updates, videos, and how-to content.</td>
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<tr>
<td>Funding source</td>
<td>Affects feasibility of implementation. Includes: source(s) of funding for the project.</td>
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Graphics are also helpful for supporting content, as long as they are well-placed, relevant, and not overly large. According to Lopuck, “in web design, large photographs or complex graphics that take up the whole page can be like lumbering elephants” (2012, p. 120). In this category, evaluation ratings were based on the overall design strategy and use of the above elements to showcase content by websites in the sample. Those with a clear visual hierarchy and good organization received the highest rating (5), while those with the least user-friendly, scattered design and no visually-prioritized sections received the lowest rating (1).

**Usability: Navigation**

User-friendly navigation is an essential component for successful web experience. There are different ways to place navigation - top, left, or right - with top and left being the preferred methods. Consistency is important, as with persistent, global navigation, where the menu remains in place on all pages throughout the website (Krug, 2014). Primary navigation is the minimum and generally appears at the top or left of the page. Secondary navigation, also known as “subnavigation” (Nielsen & Pernice, 2010) may appear below the primary bar, or can be displayed when either pointing or clicking on a section in primary navigation. There can also be tertiary (sub-subnavigation) levels, and so on. Additionally, breadcrumb-style navigation is “most useful in a large site with a deep hierarchy” (Krug, 2014, p. 80). Keeping all levels of navigation consistent and organized is essential to user-friendly design. In addition, section names should organize “similar items and features” and be based on a good sitemap with prioritized levels of content (Lopuck, 2012).

Case sites in this study were evaluated based on their overall effort in utilizing the above elements to streamline user experience in navigation, rather than the presence of all features. Those with a well-organized system and good section labeling received the highest rating (5), while those with a confusing and least user-friendly system received the lowest rating (1).

**Usability: Search Feature**

The search feature on the Internet is sometimes considered a sub-utility of web navigation (Krug, 2014). Nielsen and Pernice (2010) discuss the search feature in a chapter on navigation, though it is also mentioned in page layout discussion as part of overall selection and placement of features in creating page design. By contrast, Web Design for Dummies covers the search function as part of the “Interaction Design” discussion (Lopuck, 2012, pp. 78-80). This study treats the search feature separately from navigation. When searching for very specific solutions, especially within a larger website, users expect to find a search box to help along in their quest. Preferably, the search feature should be located where users expect it, namely in the top right corner of each page (Lopuck, 2012). For this category, websites in the study sample were evaluated based on the following elements: whether a search feature was present, the relative ease in finding it on the website, and the overall functionality of the search feature. In those cases where no search feature was located, the “N/A” rating was assigned.

**Interactive Content and Features**

Interaction is key for many users at all levels of familiarity with permaculture. Learning, browsing for general solutions, searching for a specific answer, or just being a part of the larger community are all good reasons to communicate in an interactive environment. In addition, some visitors are looking for local resources or other nearby practitioners to exchange ideas. Websites with blog comment options enabled, forums, and websites with a prominently displayed link to their Facebook page received a rating in this category, whereas those without either of these features were marked “N/A” for “not available.” Among those with interactive features, forums with recent user activity received a rating of “F” (for forums), and those with a link to their active Facebook page or a YouTube channel received a rating of “S” (for social media); forums with open blog comments received a rating of “Cm” (for comments). A combination of letters in ratings indicates a presence of multiple features in this metric.
Inclusion of Case-Studies

Case studies of implemented permaculture projects can supplement and enhance problem-solving content found on a given website, and readers may find stories inspiring. They can be similar to those covered in the literature review section of this study, or can be more or less descriptive. Project case studies in this evaluation constitute project descriptions in articles, blogs, forum threads, or in the “resources” section of the website, or the sum total of content found in these sections. Therefore, in this context a case study is a loose term encompassing all information (description, explanations, photos, videos, progress updates) across a website regarding one or more physical site(s). This evaluative category of ratings examined websites based on the amount of content describing the projects (case studies). Those with in-depth descriptions received the highest rating (5), while those with few, poor, or vague descriptions were rated lower. In cases where projects were not covered at any length, the “N/A” rating was assigned.

While permaculture methodology and application is highly transferable due to its basic principles, building on local or regional experience helps eliminate guesswork and create better and more efficient designs. For easy reference of the project scope in table format, resources evaluated in this study were also categorized in terms of geographic focus, regardless of the level of supporting detail. For the purposes of this evaluation, this category was classified as follows: “G” – global scope; “R” – regional (multiple projects in one country or geographic region); “L(s)” – local, single project; and “L(v)” – local, various projects (when located across different parts of the world).

Content Updates

Frequent updates to websites are key; this is especially true for websites with interactive focus and blogs. In terms of blog-type websites and those with project updates, consistency in documenting progress and showcasing recent developments look more appealing to the reader. With forums, a lack of recent activity and updated information may create a perception that the online community is not active or has moved on to another website. Other sections in need of regular updates are those that pertain to upcoming events (if any). This study evaluated websites based on timely updates. Those with updates within the last month received the highest rating (5), while those with less-frequently updated content were rated lower.

Resources and Links

If a website has proven to be easy to navigate and has good content, visitors may also hope to find links to other useful resources and websites. Some resources can be made available through a link, while others blend in with website content through embedded placement on-page. Visual and audio media, links to forums or other blogs on permaculture, PDF files, and book excerpts are examples of typical resource variety users might expect to find. The study evaluated the sample by considering the number, quality, and relevant nature of the resources offered by each website. Due to the limitation in the scope of this study, resources and links were randomly selected for testing as opposed to performing a complete, all-inclusive test. In addition, it should be noted that a broken link may be updated or restored at any time (though not likely), and a functioning link may likewise become broken or lead to a no-longer working site. A low quantity and/or poor quality of links and resources resulted in lower scores, while websites with many resources and links received the higher ratings. In cases where no resources or links were located, the “N/A” rating was assigned.

Problem-Solving

No matter how pleasant the browsing experience or how frequent the blog updates, some users are just looking for substance; in other words, readers want to know if there are specific answers, tips, and real-world solutions available on the website. Evaluation ratings in this category were assigned based on the amount of content that could be used in problem-solving, or troubleshooting problems likely to arise in a do-it-yourself permaculture design project. A low amount of problem-solving content resulted in lower scores, while websites with many versatile solutions (whether in forum threads or article format) received the higher ratings. Consideration was also given to the possibility that some hopeless cases may need more emergency-type intervention and users may be willing to attend a Permaculture Design Course or even hire an expert. Therefore, websites making such offerings were considered as providing a certain level of problem-
solving support.

**Financial Discussion or Tips**

While not as essential for small-scale backyard projects, financial matters are likely to be at the foundation of design for many users, both at the outset and at every new stage in permaculture design. Financial topics may include discussion about loans for permaculture projects, creating means of income while homesteading on a permaculture farm, or making the best use of existing resources and means according to the permaculture principles and philosophy. For this category, a low quantity and/or poor quality of discussion about finances or related tips resulted in lower scores, while websites with multiple articles addressing the subject, or those with opportunities to follow, continue, or open, such a discussion (as with forums) received the higher ratings. In cases where no related discussion or tips were located, the “N/A” rating was assigned.

**Funding Source**

The funding source identifies each project by type (organization or individual) and can serve to inform the reader about the aims of the project, its limitations, and its stakeholders. It may be useful to connect the metrics discussed above in the context of each website’s ownership, and to identify trends (if any) based on the type of project. The types of projects and abbreviations used are as follows: NGO – Non-Governmental Organization; P – Private; PA - Private with additional funds (donations, grants); NP – Non-Profit Organization; BOT – Build-Operate-Transfer; and C – Community.

**Results**

A summative table of the evaluation is presented at the end of this section (see Table 3). The following sub-sections describe observed trends against each evaluation criteria in more detail.

**Usability: Layout and Style**

Although very different in their layout and style selections, the majority of websites displayed good organization and simplicity in style, with elements that do not impede the browsing experience or obscure content. Pages at Reinventing Roots are grouped by related content that is also supported with relevant graphics; there is good use of headings, a simple and legible font style, and the elements are consistent throughout the site (n.d.). A two-layer background adds interest and a photo image is overlaid with a semi-opaque page to frame content. The Permaculture Magazine website also achieves a good impression, featuring clearly organized sections (“Readers’ Solutions”, “Reviews”) with good fonts, however the background here is simple—a basic white (2015). In the somewhat less effective category of websites, Pattern Literacy uses few images with a dominance of text content—which, despite good use of headings, could use grouping and added visual organization. On the other hand, Permaculture for Peace displays a persistent (all-pages) large photo with an overlaid banner, stretching from the top down to the “page fold”, which means scrolling down to view content (n.d.). The least effective design in terms of layout and style choices is at Permaculture Activist, where line borders attempt but fail to achieve intended content organization, along with low white space ratio. In addition, text line spacing is too close on most pages, and bold fonts in every shape, color, and style appear haphazard. Some pages feature block sections of bright yellow or light green background alternate in multiple shades, which makes for unpleasant reading (n.d.).

As an aside, the magazine has recently completed a successful Kickstarter campaign to raise funds for a new website.

**Usability: Navigation**

For the most part, the sample included in this study showed well-designed navigation systems, with the majority earning a “Good” or “Excellent” rating. Wayne Weiseman’s Permaculture Project has a simple, consistent navigation design whereby the website features a persistent left-sidebar menu along with breadcrumb navigation at the top, and an additional menu at the bottom of the page (n.d.). Other websites had a less intuitive navigation design and earned a slightly lower rating of “Good.” Specifically, primary or secondary navigation may have suffered from poor labeling and/or organization. An illustration of this scenario may be found at Paul Wheaton’s Richsoil website. Here, labeling does not indicate that by clicking on the “Video” section in top navigation, the user will
abandon the site and end up at Paul Wheaton’s video channel on YouTube. Also, the Blog section oddly features no blog articles, but only podcasts - which, by the way have their own section, “Podcasts” (Wheaton, 2015c).

Another commonly disorienting experience, where sections do not highlight to reflect current location, earned some websites a lower rating — as illustrated at the La’akea Community’s site (n.d.). The most confusing design is featured at Permaculture Activist. The navigation menus are located inconsistently at a different place on different pages. Clicking on the “Blog” menu option takes the user, without warning, to a series of blogs, some of which are defunct or have not been updated in years, and located on unrelated websites - with the only option: advance on to the next blog by selecting “Next” at the top of the page (n.d.).

Usability: Search Feature

Some version of the search feature was available on all except three websites in the sample. Lower scores resulted in instances where the search feature was not global; in other words, it only extended to a specific section of the website. For instance, the search feature at the Permanomades website (n.d.) is limited only to the blog section of the website. Most websites featured a simple box-style search feature, however Permaculture Research Institute’s Worldwide Permaculture Network offers an advanced version in the “Projects” section, where users may search for registered permaculture projects across the globe by keywords, climate region, or designated type (2015). One website, the Permaculture Activist, placed the search feature (powered by the DuckDuckGo search engine) at the bottom of the home page, where it may be difficult to notice, whereas other pages display it at the top center of the page (n.d.). Permies forums do not have a search box on the homepage or main forum category pages, however it appears once the user has selected a specific topic within a forum section – such as “lawn” (a topic) within the “growies” forum (Wheaton, 2015a).

Interactive Features

The majority of websites in this sample include at least some level of interactive features; however some were quite obscure in the process. For instance, Never Ending Food (2015) only links to the Facebook page following an article (at the bottom of one webpage) in the “Who We Are” section. Other websites were more successful and embedded a prominently-located preview link to Facebook, including recent posts showing in the window (as with Reinventing Roots). Half the websites allowed article and blog comments on their pages. Several websites, like the Permaculture Project, have opted to disallow comments in their blog section, possibly due to maintenance considerations such as time in managing responses and spam posts. Two large permaculture forum websites were included in this study (forums at Permaculture Research Institute and at Paul Wheaton’s site), with the latter appearing the larger of the two based on the number of visitors and total content. At Paul Wheaton’s forums website, a separate forums section called “Regional Resources” demonstrated a good level of activity with threads to connect locally in every part of the world, and may serve to further encourage international participation in permaculture (2015a).

Inclusion of Case-Studies

Informal project descriptions and updates appear in some depth or level of detail on most of the sampled websites. For most, this type of case study information is generally scattered across different sections of the website. It should be noted here, in attempting to get the “big picture” of any given project, user-friendly organization of the website (as covered in the usability metrics above) proved indispensable. At the Food Water Shelter website (2015), project details can be gathered from the yearly annual reports available in PDF format. The Panya Project community (2011) has a historic section detailing the original funding proposal and incremental progress since the beginning of the farm. Where made available, blog sections provide a well-organized venue for project updates. In the case of websites with forums, many visitors have shared details of their projects, often with added photos or other supplemental information. Never Ending Food’s “Design Ideas” section (2015) documents several local projects over the last few years, including schools, neighbors’ properties, and even a small nearby village. Depending on the needs and preferences, readers may also browse through the pages of the Permaculture Research Institute’s Worldwide Permaculture Network (listing numerous projects worldwide), or decide to
focus on immersing in a single project to get all the details (2015). Those websites with a global focus (“G”) contain numerous articles on a variety of projects worldwide, as seen at the Permaculture Magazine (2015) and Permaculture Research Institute (2015a). Websites detailing a single farm, “L(s)”, or experiences at several small farms, “L(v)”, are mainly focused on updates about their own project, as with the La’akea Community (n.d.) and Permaculture for Peace (n.d.). A distinct small group of regional project case study websites is also represented: Never Ending Food (projects in several villages in Malawi) (2015), Itinerant Permaculture (multiple educational projects, mostly in India and Cambodia) (Zook, 2012), and at Reinventing Roots (Israel’s Negev desert region, with projects in multiple Bedouin villages) (n.d.).

Content Updates

Over half the websites in the sample contain recent material updated within the last month. The updates are typically in the form of blog entries, information about a recent or future event at the project site, or an upcoming Permaculture Design Course. The Panya Project’s blog features a recent blog update about processing coffee beans by hand as part of the experiment at the farm (2011). Another example, Richsoil regularly features new podcasts about various aspects of permaculture—interviews with experts, how-to advice on popular permaculture topics, alternative energy, and more (Wheaton, 2015c). There are a few minor consistency issues associated with content updates, as with some sections of The Permaculture Magazine’s website (2015). For example, the articles here do not display dates of postings, whereas others have the dates listed, but only on the section preview page. The study also revealed similar issues with other websites. This may be confusing to readers looking for information specifically in the context of date order or new content. Itinerant Permaculture and the Permaculture Activist Magazine earned a lower rating due to a lack of recent content updates (miscellaneous postings in the schedule and events sections aside) (Zook, 2012). Similarly, at the La’akea Community website, the “Updates” section, persistent on the right side every page, has clearly not received updates in some time as it announces a tour and other events in 2013 and 2012, with no updated events added since (n.d.). Some of the websites presented embedded links to their respective Facebook or wiki pages, however, this did not help improve their respective rating in this category unless newly-updated content was embedded and visible on the website itself.

Resources and Links

There is a wide variety of permaculture resources available in this small group of websites. As might be expected, the larger websites (forums, Permaculture Magazine) offered a lot of resources. With smaller websites, even where content volume was limited, much of the information is still of good quality. For those interested in earlier, “historic” materials in permaculture, Permaculture Project shares several pamphlets in PDF format, based on a Permaculture Design Course taught by Bill Mollison in 1981. There are also images of drawings, master plans, and other resources for multiple projects in the author’s Design Portfolio section, as well as a section of design plans from student projects. Pattern Literacy offered excerpts from the author’s Gaia’s Garden book, a practical manual on permaculture, plant lists in PDF form, and articles with reflective essays grounded in the permaculture frame of reference, providing a philosophical perspective. There are also several embedded videos of Toby Hemenway’s lecture presentations. Paul Wheaton’s Richsoil website links to his YouTube channel on permaculture and also offers a large number of podcasts. Never Ending Food contains a “Research” section with links to papers and research on permaculture in Malawi (2015). Many of the websites surveyed featured embedded or linked resources, including YouTube videos and podcasts, and sometimes linked to their respective pages on Facebook. There were incidences of dead or broken links with some of the listed resources, for instance at La’akea Community website and Rico Zook’s I-Permaculture site (2012).

Problem-Solving

For the most part, the larger websites in the group offer the best option for finding solutions, and appeal to a wide, international audience. This is due to the broad global scope with coverage of diverse projects worldwide. Forums at Permaculture Research Institute and Permies websites have a wealth of content, and users have the freedom to build on prior discussions or start a new thread. Examples of current threads dealing
with issues include “need advice on squirrel control” at Permies’ Critter Care forums (Wheaton, 2015a), and “Establishing orchard - to swale or not to swale?” at Permaculture Research Institute forums (PRI’s Permaculture Forums, 2015c). When looking for an area-specific answer (best locally available renewable resources, water harvesting laws, etc.), the smaller, local websites such as the Panya Project (2011) and Never Ending Food (2015) also had good information and articles to offer. With both of the above projects, the websites offer visits so that local residents may arrange a site visit to get answers or suggestions in person. A half of the websites in this category received low scores. While they offered some combination of workshops, PDCs, and design or consulting services, for someone browsing for no-cost solutions (or just not willing to commit), PDCs and consulting are not much help. One exception is a low-commitment course at Permaculture for Peace, where users can “drop-in” at any course online for a small donation of ten U.S. dollars (n.d.).

Financial Discussion or Tips

The vast majority of websites in this study do not specifically address financial topics. As to those with financial topics present, The Permaculture Magazine has several interesting articles in this regard (“Learn Permaculture Design for Free” and “How to Crowdfund Your Permaculture Project”; Adams, 2012; Harland, 2014). While originally part of the paid magazine content, these were made available as blog posts for free access. At Permies forums, there is a separate forum on “financial strategy” under the “living” section (Wheaton, 2015b), with threads like “farm land financing” (Hunter, 2014) and “investing the permaculture way” (Lapointe, 2013). The Permaculture Research Institute, in its financial management section, offers articles and tips, two examples being “Crowdfunding Your Permaculture Project – Which Type is the Best Fit?” and “3 Keys to Starting A Successful Permaculture Based Business” (Permaculture Research Institute, 2015b). The complementary forums section of this site does not appear to have much easily-identifiable and current content related to financial tips, however users may post new threads with specific questions of their choice.

Funding Source

Information about the project funding sources is generally included in the “About Us” or a similar section of the website. Some projects use mixed funding sources to promote permaculture in the area, such as Never Ending Food, where in addition to private funding and grants there is a separate section for donations (2015). Another growing trend is to utilize a well-known crowdsourcing platform like Kickstarter to help with funding. A recent successful campaign by the Permaculture Activist Magazine to raise funds for updating the website and digitizing content of past magazine issues is a great example. At Paul Wheaton’s Richsoil and Permies forums websites, Kickstarter campaigns serve to create an educational permaculture deck of playing cards and a set of DVDs on rocket mass heaters (2015a; 2015c). In addition to the majority of privately-funded projects, two Non-Governmental Organizations, two community-funded projects, and one Balance Operate Transfer organization are featured in this study.

Additional Resources on Permaculture – Facebook and YouTube

Many of the websites in this survey also maintain a Facebook page. Facebook does not tally the number of pages in a keyword search, but according to Google, there are over 500 Facebook pages that include permaculture in their name. Some, of course, do not explicitly state “permaculture” in the title. In addition, many more incorporate permaculture ideas and applications alongside other sustainable methods in their work. Overall, on Facebook there appears to be a lot of activity on the topic of permaculture – with individuals, non-profits, educational and community organizations, landscaping services, and permaculture farms present, among others. A search for “permaculture” on YouTube currently yields around 189,000 results. Since individual users self-post content, video titles and tags may be riddled with spelling errors or not very descriptive titles. There is an interactive component in that users are able to discuss content, as long as comments are not disabled for the specific video. Other, mostly relevant suggestions appear on the sidebar. Advertisements hinder the interface but mostly are a minor annoyance. There are around 30,800 YouTube Channels ready to follow; some channels include just compilations, while
others offer self-recorded material. Some of the videos include recordings of the Permaculture Design Course, a great resource for those who have not received this training or would like to refresh their knowledge. YouTube also contains videos in other languages, which is an added benefit to multi-lingual users and those based in non-English speaking countries. A free account is required to subscribe to a channel, upload content, and create playlists.

Discussion

Whereas Scott (2010) has argued the permaculture literature is lacking updates and content can be redundant, the answer may rest in supplementing such existing information with current online resources. Updates that are even in small numbers (such as those evaluated in this study) appear to fill the gap quite well and present content that is very diverse.

This study evaluated a sample that illustrates resource diversity in terms of content and delivery (types of media), with good quality of resources overall. The larger websites cover significantly more content, and are much more diverse in scope than those devoted to

Table 3. Evaluation table of online permaculture resource case-site

<table>
<thead>
<tr>
<th>Website (name and URL)</th>
<th>Usability: layout and style</th>
<th>Usability: navigation</th>
<th>Usability: search feature</th>
<th>Interactive features</th>
<th>Inclusion of case-studies</th>
<th>Content updates</th>
<th>Resources and links</th>
<th>Problem-solving</th>
<th>Financial discussion</th>
<th>Funding source</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRI, <a href="http://www.permacultureglobal.org">www.permacultureglobal.org</a> <a href="http://www.permaculturenews.org">www.permaculturenews.org</a></td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>F</td>
<td>5 G</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>NP</td>
</tr>
<tr>
<td>Permaculture Activist <a href="http://www.permacultureactivist.net">www.permacultureactivist.net</a></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
<td>N/A</td>
<td>2</td>
<td>2</td>
<td>N/A</td>
<td>N/A</td>
<td>PA</td>
</tr>
<tr>
<td>Permaculture Magazine <a href="http://www.permaculture.co.uk">www.permaculture.co.uk</a></td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>Cm, S</td>
<td>5 G</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>P</td>
</tr>
<tr>
<td>Paul Wheaton: <a href="http://www.permies.com">www.permies.com</a> <a href="http://www.richsoil.com">www.richsoil.com</a></td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>F, S</td>
<td>5 G</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>PA</td>
</tr>
<tr>
<td>FoodWaterShelter (Kesho Leo Children’s Village) <a href="http://www.foodwatershelter.org.au">www.foodwatershelter.org.au</a></td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>N/A</td>
<td>3 L(s)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>N/A</td>
<td>NGO</td>
</tr>
<tr>
<td>La’akea Community <a href="http://www.permaculture-hawaii.com">www.permaculture-hawaii.com</a></td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>N/A</td>
<td>3 L(v)</td>
<td>4</td>
<td>2</td>
<td>N/A</td>
<td>N/A</td>
<td>C</td>
</tr>
<tr>
<td>Never Ending Food <a href="http://www.neverendingfood.org">www.neverendingfood.org</a></td>
<td>4</td>
<td>5</td>
<td>N/A</td>
<td>N/A</td>
<td>5 R</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>N/A</td>
<td>PA</td>
</tr>
<tr>
<td>Permanomades <a href="http://www.permaground.wordpress.com">www.permaground.wordpress.com</a></td>
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<td>4</td>
<td>4</td>
<td>Cm, S</td>
<td>4 L(v)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>N/A</td>
<td>P</td>
</tr>
<tr>
<td>The Panya Project <a href="http://www.panyaproject.org">www.panyaproject.org</a></td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>Cm</td>
<td>4 L(s)</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>N/A</td>
<td>C</td>
</tr>
<tr>
<td>Reinventing Roots <a href="http://www.reinventingroots.com">www.reinventingroots.com</a></td>
<td>5</td>
<td>4</td>
<td>N/A</td>
<td>N/A</td>
<td>1 R</td>
<td>5</td>
<td>2</td>
<td>N/A</td>
<td>N/A</td>
<td>BOT</td>
</tr>
<tr>
<td>Permaculture for Peace <a href="http://www.permaculture4peace.org">www.permaculture4peace.org</a></td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>Cm</td>
<td>1 L(v)</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>N/A</td>
<td>NGO</td>
</tr>
<tr>
<td>PermacultureProject.com <a href="http://www.permacultureproject.com">www.permacultureproject.com</a></td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>Cm, S</td>
<td>3 L(v)</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>N/A</td>
<td>P</td>
</tr>
<tr>
<td>Rico Zook (Itinerant Permaculture)</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>Cm</td>
<td>3 R</td>
<td>3</td>
<td>3</td>
<td>N/A</td>
<td>N/A</td>
<td>PA</td>
</tr>
</tbody>
</table>

NGO – Non-Governmental Organization; P – Private; PA – Private w/ additional funds; NP – Non-Profit Organization; BOT – Build Operate Transfer; C – Community; Cm – Comments; F – Forums; S – Social Media; G – Global; R – Regional; L(s) – Local, single project; L(v) – Local, various projects

N/A – not available; 1 – very poor; 2 – poor; 3 – fair; 4 – good; 5 – excellent
one or two projects. The individual project sites (with single, various, or regional projects) offer content with a more narrow focus in a specific climate and cultural setting, which allows a closer look at specifics. Mostly, the content focuses on creative, practical solutions within the framework of permaculture, as opposed to discussion of permaculture in an academic context. Examples include topic-specific discussions in problem-solving, projects of various scope with supporting visual details, and even some financial guidance provided by some of the websites in the sample. Project case studies also include models for community and NGO projects; these categories in themselves warrant future research due to the potential social and economic impact.

While permaculture is experimental (if only because natural patterns have become so foreign to many in today’s world), the content in this sample of websites provides a solid frame of reference to help absorb the methods, ethics, and applications. This is important as few have the skills, time, or financial resources to manage a permaculture project without the shared pool of knowledge from the permaculture community at least part of the time.

In terms of usability, the websites in the sample are largely accessible and user-friendly, with the exception of the Permaculture Activist, where upgrades will soon be underway. Navigation and search features are generally good, though some improvements would further increase accessibility to the users. The websites make use of good fonts and many use headings, though none appear to have experimented with some of the finer stylistic techniques, such as leading (covered in the section on website usability). Detracting from the overall quality in the sample are a few cases with rarely updated content and those with poorly designed content organization. Several websites do not offer much case study material and only briefly demonstrate their projects. This may be, at times, due to the existence of a respective Facebook page with project updates; however the study does not include these as part of the evaluation. Facebook and other social media websites present a potential area for research in the permaculture movement that would augment the findings presented above.

Websites in this study also show content designed to attract interns and volunteers, potential community members, or Permaculture Design Course (PDC) participants. To this extent, a fair amount of information on evaluated websites is devoted to showcasing the physical site and its appeal. Whether such visits and on-site training are on the increase or decline is a question that may suggest further research. Regardless of the actual numbers however, the PDC remains critical to the permaculture movement as the most in-depth format with experiential and team-learning components. However, there are now online versions appearing due to lower cost and higher demand (e.g., aimed at those who cannot travel due to obligations, scheduling conflicts, or added cost). Permaculture for Peace is one of the organizations in this sample offering such a flexible learning experience.

As concerns further research, a physical visit to permaculture site locations would expand and enrich the findings presented in this study, as well as present a wealth of data for additional inquiry. One such area would be to examine effects on local biodiversity. Another study might focus on areas of convergence between permaculture and traditional practices as a way of indigenous cultural preservation. In more broad terms, because permaculture connects several disciplines, it offers a wide range of opportunities not simply for research within those fields, but also for collaborative, interdisciplinary type of studies.

**Conclusion**

This study has created a simple evaluative framework for online permaculture resources, based largely on best practice identified in the literature on web-design and communication. This framework was then applied to a non-representative sample of permaculture websites. Findings from the evaluation demonstrate that the online permaculture community is capable of providing support and the necessary knowledge to help beginners move into a more sustainable direction in land use and care, and to provide continuing expertise to those with ongoing projects. Part of the process is being able to vision such systems and to be inspired by others’ results. A land use study by Boland (2014) addresses the importance of such perceptions. With large-scale applications, permaculture offers inspiring and valuable case studies that can be applied to lessen
effects of pollution, climate change, and even normalize rainfall patterns. The inspiration and guidance needed to bring permaculture to life is available in the sum total of resources evaluated in this study.

References


The Effects of Peer Mentoring on Students with Autism Spectrum Disorder

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Department of Curriculum and Instruction

Faculty Mentor: Dr. Peggy J. Schaefer Whitby
Department of Curriculum and Instruction

Abstract

The purpose of this study was to determine the characteristics of students with autism and their peer mentors that may contribute to the success of peer-mediated intervention strategies. Target students and peer mentors were matched based on skill level, age, and preferences; the students participated in a variety of activities throughout a week-long day camp. Peer mentors were taught how to interact with students, and behavior technicians were trained to facilitate these interactions. A qualitative case study was designed to determine patterns across the matched pairs. Findings indicate that peer mentor characteristics and the characteristics of the target student contribute to the success of a peer mentoring intervention.

Introduction

Autism spectrum disorder (ASD) is an all-encompassing term used to describe a complex, lifelong developmental disability. The disability is characterized by deficits in social interactions, nonverbal communications and behaviors, and development and maintenance of meaningful relationships (American Psychiatric Association, 2014). Individuals may or may not experience all symptoms typically associated with autism; additionally, the severity of those symptoms varies from person to person. Individuals with ASD often experience qualitative impairments in social interaction, communication, and repetitive behaviors (Autism Speaks Inc., 2014; Kishore & Basu, 2014; Lesack, Bearss, Celano, & Sharp, 2014), as well as difficulties following social interaction norms, understanding nonverbal communication, and identifying functional limitations of social interactions (American Psychiatric Association, 2014).

According to the Center for Disease Control and Prevention [CDC] (2014), more than 2 million individuals in the United States are affected by ASD. Every year, about one in every 68 American children is diagnosed with ASD. ASD can affect individuals regardless of ethnicity, race, gender, or socioeconomic status, and autism is four- to five-times more common in boys than in girls (CDC, 2014). In the last 40 years, the prevalence of ASD has increased tenfold, and ASD diagnoses continue to increase by 10% to 17% annually (Autism Speaks Inc., 2014). Although increased awareness and accurate diagnoses may be contributing factors, there is no concrete explanation given for the increase in children diagnosed with ASD in recent years.

Although each child diagnosed with ASD may experience symptoms of varying severity, Willis (2006) states that all children on the spectrum have difficulty or delays in: 1) language and communication, 2) social relationships, and 3) response to sensory stimuli. The author also notes that children with autism may display atypical or inappropriate social behaviors which, in turn, can cause social isolation (Willis, 2006). The purpose of this study was to investigate the use of a peer-mentoring intervention to increase social interactions between children with autism and typical peers without autism as a means to address social isolation.

Literature Review

Peer-mediated intervention strategies are most commonly based on social learning theory. Bandura (1977) emphasizes that psychological functioning is not influenced by inner forces or external environmental factors; rather, this functioning is determined by “reciprocal interactions between behavior and its controlling conditions” (p. 2). Social learning theory suggests that humans can learn through both direct experiences and through modeling. In keeping with this theory, humans learn behavior by observing others instead of simply learning patterns through trial and error. Bandura (1977) also notes that humans are in control of their own behaviors, and self-regulative influences can serve as causal consequences for one’s
actions.

As peer-mediated programs continue to gain popularity in the school setting, there is an increased pressure to ensure that these programs are beneficial to both the target student (the child with ASD) and the typically developing peer mentor. Deutsch and Spencer (2009) state that individual relationships (between the mentor and mentee), and components of the program as a whole, must be understood in order to fully assess the quality of said program. Rhodes and DuBois (2006) recommend policies be put in place that will “promote evidence-based innovation, rigorous evaluation, and careful replication … and encourage intentional and scientifically informed approaches to mentoring across the full-spectrum of youth-serving settings” (p. 1). If these requirements are met, mentoring programs should yield benefits for both the peer mentors and mentees.

In order to ensure that students will benefit from peer-mediated interventions, a specific process should be followed. There are a number of peer-mediated programs that can be used by teachers in an elementary setting; one such program, peer-mediated instruction and intervention strategies (PMII), is described in detail by Sperry, Neitzel, and Engelhardt-Wells (2010). This type of intervention is designed to “systematically teach typically developing peers way of successfully engaging children with ASD in positive social interactions” (Sperry et al., 2010, p. 256). The peer must be explicitly taught to interact in a meaningful and positive way with their classmates on the spectrum. The teacher must also follow a set procedure, consisting of five steps, in order to ensure that the intervention is as effective as possible.

The first step is to select peer mentors to participate in the intervention. Sperry and colleagues (2010) list the characteristics an ideal mentor should demonstrate. Peers should: be well liked by their peers, have a positive or neutral history with the target student, exhibit good social skills and age-appropriate play skills, show interest in participating, attend school regularly, follow adult instructions, and be able to attend to a task for at least 10 minutes. Peer models should also be able to develop friendships easily, be socially competent, and be socially responsive to their classmates (Sartini, Knight, & Collins, 2013). Locke, Rotheram-Fuller, and Kasari (2012) suggest that peers should be the same age or older than the target student, be academically strong, and have confidence in their leadership abilities.

Step two involves training and supporting the peer models. As previously mentioned, peers should be explicitly taught how to positively and effectively interact with students with autism. Teachers should discuss the similarities and differences between children with ASD and their typically developing peers, provide examples of observable behaviors children with ASD might exhibit, and teach specific strategies (such as sharing, providing assistance and praise, and basic play behaviors) to support the interaction between peers and the target children (Sperry et al., 2010).

During step three of PMII, a structured teaching session is implemented. Peers are given the opportunity to practice the skills they were taught in step two with the target children. The teacher introduces the daily activity, prompts the peer to interact with the target child, and reinforces appropriate behavior on the part of the peer and the target child.

In step four, the teacher should focus on implementing the peer-mediated intervention in the classroom and school setting. Sperry et al. (2010) suggest that teachers take a number of factors into account before implementation: classroom arrangement, selection of materials, appointment of responsible staff members, and the use of prompts and reinforcements. The peer-mediated intervention should be integrated into the daily schedule and occur at the same time each day. Target students should know what is expected of them during these activities. Prompts and reinforcements should be decreased throughout the implementation of the intervention.

The final step involves generalizing and expanding peer interactions throughout the rest of the school. The target child should have opportunities to initiate and participate in new and different types of social interactions with their peers each day. In order to provide these opportunities, teachers should consider increasing the number of peers who interact with the target child, or systematically rotating the peers interacting with that child (Sperry et al., 2010).

An ample amount of research has been conducted in order to determine the effects of peer mentoring on target students, including individuals on the autism spectrum. Positive and meaningful relationships are formed through peer mentoring programs; these relationships, according to Smith (2011), positively influence behavior change (e.g., decreases in repetitive behavior, and increases in appropriate social behavior), as well as help the target students overcome social,
personal, and academic barriers. Peer mentors also encourage the mentee to achieve success in everyday life. Peer-mediated interventions give the target student ample opportunities to improve social skills in a natural setting (Battaglia & Radley, 2014); the same study suggests that these interventions should increase the student’s ability to communicate, initiate and maintain peer interactions, and take turns speaking, while decreasing undesirable social behaviors. Ogilvie (2011) mentions some strategies that can be used when mentoring a child with autism. The child and their peer mentor can work together on an assignment during class, participate in a social skills group, and role play various social situations they may encounter in the real world. Through these activities, research findings suggest that students with autism were better able to socially interact with their peers and were able to maintain the skills learned during the intervention (Ogilvie, 2011). Another study by So Hyun, Odom, and Loftin (2007) also yielded positive results. In this study, three children with high rates of stereotypical autistic behavior interacted with two typically developing peers during structured play activities. Researchers found that, through this intervention, all three children showed “collateral decreases in stereotypical behavior … and the results were generalized to a proximal play setting” (So Hyun et al., 2007, p. 67). The authors also found that social engagement and interaction decreased both simultaneous and motor stereotypical behaviors for the children with autism. These studies suggest that, through peer-mediated interventions, a child’s atypical behaviors will decrease, and social interactions with their peers will increase; these factors, in turn, lead to improved social skills and a sense of belonging in the classroom.

Because elementary-aged children spend the majority of their time in a school setting, it is crucial that all students have opportunities to form friendships with their peers and collaborate based on similar interests. Providing a safe and nurturing environment in which positive peer-to-peer interactions are encouraged leads to more positive outcomes and greater social skills, specifically in regard to elementary students (Grossman, Goldsmith, Sheldon, & Arbreton, 2009). School-based mentoring programs are the most common form of mentoring in today’s education system because children spend so much of their time at school. Although school-based mentoring programs may not allow for as much flexibility as other programs, the benefits far outweigh the minor drawbacks. Smith (2011) suggests that peer mentoring interventions allow children with autism to develop social skills, as well as increase their self-esteem and self-efficacy.

Although there is a decent amount of research on the effects of peer mentoring strategies and interventions on children with autism, there is little research on the effects of these interventions on the peer mentors. The purpose of this study is to identify the characteristics of a successful peer mentoring relationship, as well as the benefits for the typically-developing peer mentors participating in the interventions. The results of the peer mentoring interventions will be reviewed in order to identify both positive and negative impacts experienced by the typically-developing children.

Characteristics of a Suitable Target Student

Children on the autism spectrum who exhibit limited communication skills, do not respond or initiate social interactions with peers, and struggle in a group context are good candidates for peer-mediated interventions (Sperry et al., 2010). It is also important to “consider the student’s current level and mode of communication and social interaction” (Sartini et al., 2013, p. 56) when planning and implementing a peer mentor program; the teacher should select goals for the target student based on these factors.

In order to determine the most beneficial approach for the target student, the teacher should decide if the student has a performance or acquisition deficit. If a performance deficit is present, the target student should be provided with “increased opportunities to practice the target [social] skill” (Battaglia & Radley, 2014, p. 6); if an acquisition deficit is present, the intervention should focus on providing the child with opportunities to learn the target skill, as well as receive feedback through peer modeling and direct training (Battaglia & Radley, 2014).

Characteristics of a Suitable Peer Mentor

Sperry et al. (2010) indicate that there are several traits that qualify a student as a good peer mentor; peer mentors should “exhibit good social skills, language, and age-appropriate play skills, be well-liked by peers, have a positive social interaction history with the focal child, be generally compliant with adult directives, attend to an interesting task or activity for 10 minutes,
be willing to participate, and attend school on a regular
basis” (p. 257).

It is suggested that peer mentors be “socially
connected to children with ASD, as well as other
classmates, and maintain a strong and positive role
within the classroom” (Locke et al., 2012, p. 1895). Children selected as peer mentors should be capable of
developing friendships with the target child, and should
be self-confident leaders in the classroom (Locke et
al., 2012; Sartini et al., 2013). From observation of
the students who participated in the program, peer
mentors should have prior knowledge of and first-hand
experience working with children with disabilities.

Although all of the characteristics mentioned
above are important in ensuring success in a peer-
mediated intervention, the peer mentor should exhibit
five defining characteristics in order for the interventions
to be the most beneficial for the target student. These
five characteristics were selected based on research of
published literature and personal observations made
during the summer program. Peer mentors should be
able to follow instructions given by adults, be willing
to participate, have first-hand experience working with
children with special needs, be self-confident leaders,
and be socially responsive to their peers (both typically
developing and those with special needs).

Methodology

The purpose of the study was to investigate
the use of peer mentors to facilitate social interactions
for students with autism at a Northwest Arkansas day
camp. This section outlines methods and procedures. A qualitative case study design was used to determine
patterns across matched pairs.

Research Questions

1. What are the characteristics of a peer mentor that
contribute to the success of a peer-mentoring program
for students with autism spectrum disorders?
2. What are the characteristics of a student with autism
that contribute to the success of a peer-mentoring
program?
3. Are the findings consistent with those identified by
Sperry et al. (2010)?

Selection of Cases

Sample selection was purposive in nature. Eleven case study pairs were selected based upon attendance at camp, consent from parents and guardians, completed applications, and completed data collection forms from behavior technicians. Out of the 20 peer-
mentoring pairs, 11 met the criteria for analysis. The data for this study were collected in the summer of 2014
and analyzed post hoc throughout the fall and spring of
2015.

To further illustrate the findings, two case studies
were identified from the original 11 case study pairs for
in-depth analysis. These two cases were selected based
upon success of the peer mentor relationships or the lack
of success of the peer mentor relationship. The most
successful and least successful cases were selected and
discussed.

Data Collection

In order to identify themes across case
studies, data triangulation procedures were utilized. Data triangulation included record reviews, direct
observation, and data collection.

The completed applications were reviewed by
the program administrator and kept in a secure location
throughout the program and data analysis process; researchers had access to these applications for data
collection purposes only. These applications were used
to gather demographic data on the children participating
in the program. Additionally, the data sheets were
kept in the same secure location and were available to
researchers for data analysis purposes.

Inter-observer agreement data were not collected
during this study due to the researcher to camper ratio;
each researcher was assigned to observe a child with
autism and their typically developing peer mentor. Had there been more researchers available during
the program, this data would have been collected and
reviewed.

Record Reviews. In order to attend camp, parents were asked to complete an application. Both
mentors and target children completed the application
process.

Applications for children with autism were
extensive and required parents and guardians to provide
information including the child’s demographics (name,
gender, age, grade), diagnoses, likes and dislikes,
strategies, skill level (toileting, dressing, eating), behaviors, emotional development, social development, and communication skills.

The peer mentors’ parents and guardians were also asked to complete a registration form in order for their children to attend the program. Parents and guardians provided information regarding their child’s demographics (e.g., name, gender, age, grade), likes and dislikes, hobbies, and academic and extracurricular activities.

**Direct Observation.** Daily observations of peer-mentoring pairs were conducted by doctorate-level behavior analysts. Observations were conducted during social play activities and during a one-to-one teaching session each day. Behavior analysts modeled appropriate support techniques such as prompting and reinforcement for the behavior technicians to facilitate the interaction of both the mentors and target students. Behavior technicians were given feedback daily from the behavior analysts on their performance in supporting the peer mentor relationships. Behavior analysts specifically observed for aggression (both verbal and physical), elopement, number of interactions between the pair to determine what level of prompting and reinforcement each pair would require.

**Data Collection.** Data were collected every day throughout the camp experience on time on-task, instructional strategies, the student’s engagement in activities, manding, and peer interactions. Marding is defined as a verbal operant that is brought about by a modus operandi (MO) and followed by specific reinforcement (Cooper, Heron, & Heward, 2007).

Behavior technicians were given an hour of training each day before camp activities began; researchers were taught how to annotate specific behaviors on the data collection sheets, and what types of behaviors to look for in the children with autism. Doctorate level students trained the undergraduate level behavior technicians.

Data were organized in an Excel spreadsheet so that themes across student characteristics, peer mentor characteristics, and outcomes could be identified. Two researchers reviewed and sorted the data based on overall perceived success of the peer-mentor relationship. Pairs were labeled either successful or unsuccessful based on social interaction and consistent engagement of the peer mentor throughout the week. Interrater agreement on the successful participation was 100%. Themes were identified regarding the characteristics of the peer mentor that may or may not have contributed to the successful relationship. Each peer was rated on the characteristics of a good peer mentor based upon the research of Sperry et al. (2010). Two researchers rated each peer mentor, and interrater agreement was 100%. Each target student was rated on the characteristics of a good candidate for using peer mentor interventions based on the research of Sperry et al. (2010). Upon review of the characteristics of a good candidate for peer mentoring, it was determined that ability to imitate, aggression, elopement, and the ability to follow simple directions were characteristics of the learner that may contribute to success, and were therefore included in analysis of the data.

**Setting**

The setting was an inclusive day camp designed for students with autism spectrum disorders in the Northwest Arkansas area. Camp was held on a community church campus in Northwest Arkansas; however, there was no religious affiliation between the church and the program. Camp was held for four hours per day for one week (Monday through Friday). Two groups were held: ten campers and ten peer mentors participated in each session of the program.

Teaching space consisted of a large theatre, three classrooms, a snack area, and a large outside play area. The daily schedule included highly preferred activities across each setting. The schedule was consistent across each day. Campers and peers were rotated through each activity to avoid overcrowding in the play areas. Activities consisted of small-group, large-group, and one-to-one play. Each camper and peer were provided a daily schedule, either in a picture schedule or in a picture schedule with words depending on the needs of the camper.

**Participants**

Ten students with autism and ten typically developing peers aged 5 to 8 participated in the first week of the program; ten students with autism and ten typically developing peers ages 9 to 12 participated in the second week. The program was advertised across the Northwest Arkansas area, and families volunteered to attend (both the target students and the peer mentors). The students’ parents and guardians were asked to complete a questionnaire providing information about...
their children’s demographics, behavior characteristics, preferences, and interests. Target students were paired with peer mentors based on the answers provided on the questionnaires.

Two mentoring pairs were identified based on being most successful and least successful peer mentoring partnerships. Two case studies are presented in detail to illustrate the findings. Summaries of the characteristics of each peer-mentoring partnership, in relationship to findings in the literature on which characteristics should be exhibited by the mentor and target student, are provided in the results section.

**Procedures**

Camp announcements were sent to agencies across Northwest Arkansas that support people with autism and related disabilities. These agencies included autism-support groups; speech, occupational, and behavior therapy agencies; and local special-education programs in the public school systems. Solicitation for participants began on May 1, and the deadline for complete camper and peer mentor applications was due on June 15. Acceptance was on a first-come-first-serve basis. Applicants after the first 20 were placed on a waiting list.

**Choosing and Training Peer Mentors.** Sperry et al. (2010) suggested a five-step process for using peer-mediated instruction and intervention strategies: selecting peers, training and support, structured teaching, and implementing the intervention in a classroom setting. The following outlines the training procedures according to these steps.

**Peer Mentor Selection.** The sample for peer mentors was purposive. Twenty students applied to attend camp and were automatically accepted as a peer mentor. Campers were then matched with mentors based upon interest, age, and skill level. Given all campers had to be matched with a peer based upon whoever applied, the “best match” possible was made. First, pairs were matched based on skill level. Peers who had more first-hand experience with people with disabilities were matched with students needing the most support. Age was also taken into consideration, so that younger children were not placed with older children, if at all possible. Preferably, the peer mentors were the same age or older than the target student. Finally, peers were matched based upon their interests to facilitate commonality between the pairs.

**Training and Support.** On the first day of camp, peers were asked to arrive one hour early for training. Peer mentors received one hour of training, which consisted of understanding autism, learning how to be a friend to a child with autism, gaining strategies to engage children with autism in activities (e.g., prompting and reducing the number of words), and knowing what to do if your new friend is frustrated (e.g., how to ask the behavior technicians for help and remove oneself from the area). With each topic, the students had the opportunity to role play with each other and with an instructor.

**Implementing Peer Mentoring.** The classroom setting and activities were set up to facilitate peer interactions (see schedule). Highly preferred activities for both the peers and learners were set up at centers. The pairs were instructed to stay together during these activities. The pairs rotated throughout the centers and played one-to-one during the teaching time.

**Training Behavior Technicians.** Each pair of students was assigned a behavior technician in training. Behavior technicians were undergraduate- and graduate-level students interested in learning how to apply behavior support techniques for children with autism. Behavior technicians spend three hours per day (before camp activities began) in training. On day one, the behavior technicians learned about autism, their camper, data collection procedures, and ways to support the peer mentor. Other learning topics included functional behavior assessment, discrete trial training, reinforcement, naturalistic teaching techniques, and crisis management. Each day after camp, the behavior technicians met with the behavior analysts to debrief and to receive feedback on how to better facilitate the peer relationships.

The author participated as a behavior technician during both sessions of the program. It was the responsibility of the author to facilitate social interactions between the target student and their peer mentor, as well as collect data on those interactions using the data sheet provided in Appendix F. The author received three hours of training each day before camp, as well as ongoing feedback from the behavior analysts each day after camp.
Results

The results of this case study are based on triangulation of data (observation, documentation, and data collection). Themes within the data across participants were identified by two researchers and compared until a consensus was found. Peer mentor data and learner data were both compared to the findings in Sperry et al. (2010). Then, the data were compared to the report outcome of the peer relationships (successful or unsuccessful). Data on each pair can be found in table 1.

In Table 1, some of the characteristics of the camper and their peer mentor are listed. “Verbal Communication” refers to the target students’ ability to independently communicate with peers and adults; “Social Initiation” refers to the target students’ ability to independently initiate social interactions with their peer mentor. The “Group Setting” column indicates whether or not the target students struggled in a group context. “Defining Characteristics” refers to the number of characteristics (mentioned in Sperry et al. (2010)) the peer mentor exhibited in each pair. Finally, “Outcome” refers to the overall success of the peer mentoring relationship.

Several different factors were taken into account in order to gauge the overall success of each peer mentoring pair. Most importantly, the number and type of interactions were tallied; the more meaningful interactions a group had, the more successful their outcome. If, by the end of the week, the majority of the interactions were unprompted (the interaction was initiated by the peer or the child with autism), and the number of interactions increased, researchers considered the outcome successful. If the children were not engaging in social interaction throughout the day, or the number of interactions decreased throughout the week, the outcome was considered unsuccessful.

Each child’s diagnosis is included in the table above. Researchers relied on parent reports for diagnostic confirmation; it is important to note that some of the children who participated in the program had been working with the camp administrator and several of the graduate level students. Because of this, the administrator and graduate students were able to confirm the diagnosis of several of the campers. In some cases, however, researchers had to rely strictly on parent report.

Based on direct observation during the summer program, parent reports, and characteristics identified by Sperry et al. (2010), we listed five defining characteristics that contribute to the success of peer-mentoring interventions. If the peer mentor possessed the five defining characteristics, there was a positive effect on the overall success of the outcome.

We also found that there are certain characteristics the target student should exhibit in order to benefit from peer-mediated strategies. For example, the target students benefited from the program if they exhibited limited communication skills, struggled in a group context, and did not respond to or initiate social interactions with their peers. However, if the child showed signs of aggression toward themselves or others, eloped, or lacked the ability to imitate certain behaviors in a social context, there was a negative effect on the overall success of the outcome.

Our findings regarding the characteristics of a successful peer mentor were consistent with the

<table>
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<tr>
<th>Pair</th>
<th>Diagnosis</th>
<th>Camper Age</th>
<th>Verbal Communication</th>
<th>Social Initiation</th>
<th>Group Setting</th>
<th>Aggression</th>
<th>Elopement</th>
<th>Imitation</th>
<th>Mentor Age</th>
<th>Defining Characteristics</th>
<th>Outcome</th>
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characteristics mentioned in Sperry et al. (2010). Although we concluded that the target student should exhibit the three characteristics mentioned in the literature, we also found that the presence of aggression, elopement, and lack of imitation skills negatively contributed to the overall success of the peer-mentoring program.

In the sections below, two case studies- the most successful and least successful pairing- were chosen and discussed in further detail to analyze the effects of peer mentoring on both the target child and the peer mentor. Ben and Kasey (pair 1) had the most successful peer mentoring relationship, while Adam and Amy (pair 2) exhibited the least successful relationship. As previously mentioned, the number and type of interactions and the overall engagement of the child with autism and their peer mentor were examined when determining the outcome of the relationships. In addition, Ben exhibited two of the three characteristics of a child who would benefit from a peer mentoring intervention, and Kasey exhibited the defining characteristics of a successful peer mentor. Adam exhibited all three characteristics of a child who would benefit from a peer mentoring intervention, but his peer mentor, Amy, showed only two of the defining characteristics of a successful peer mentor.

**Camper (Target Child) 1 Characteristics**

Ben (pseudonym) is a ten-year-old, male student who attended the second program session (from July 28 through August 1). Ben had completed third grade before attending the program. He has been diagnosed with autism spectrum disorder, a communication disorder, and Attention Deficient and Hyperactivity Disorder (ADHD). On Ben’s camp registration form, his mother specified his communication disorder by stating, “He doesn’t know when to ask sometimes and is learning to talk a little.” Ben’s mother indicated that he uses a visual schedule for half of the day; he also uses relaxation protocols in the form of pushing or holding a pillow. Ben is completely independent in regards to toileting, dressing, and eating.

Ben’s emotional development seems to be delayed. He is not yet able to request a break when he becomes frustrated or upset, does not request assistance independently, and does not express confusion. Ben does not indicate his likes and dislikes to adults or peers. With some assistance, Ben can express his feelings. Ben can indicate relaxation with complete independence. I served as Ben’s behavior technician during his camp session, thus the researcher was able to observe his emotional and social development, as well as his social interactions throughout the week. There were several instances where Ben would indicate that he was upset or frustrated, either by crying, yelling, or eloping from the current situation. However, he was not able to articulate his emotions verbally.

Ben also experiences some delays in his social development. On the registration form, Ben’s mother indicated that he does not engage in solitary play, but he will engage in parallel play with peers. With some assistance, Ben will participate in group play and will share materials with his peers. He will take turns without needing to be reminded. Ben’s mother mentioned that he enjoys imaginative play.

Ben needs assistance following nonverbal directions, but can independently follow verbal directions within familiar routines. With some assistance, Ben can follow verbal directions within novel activities, utilize visual supports to follow directions, and make requests for basic wants and needs. He can independently use pictures, signs, and other augmentative communication methods. Ben is able to converse with peers and adults with some assistance and prompting. According to his mother, Ben makes eye contact with children and adults, but requires some assistance to progress to the next step of verbal communication. During group activities, Ben would approach his peers (both typically developing and those with special needs) and make eye contact with them. However, he did have some difficulty verbally communicating with others.

**Peer Mentor 1 Characteristics**

Kasey (pseudonym) was selected as Ben’s peer mentor. She is a 12-year-old female who had completed seventh grade before attending the program. Having worked closely with her, the author was able to observe Kasey’s personality and characteristics throughout the week.

Kasey was competent in her social and language skills and engaged in age-appropriate play skills throughout the variety of activities offered during camp. Her peers, both typically developing and those with special needs, seemed to get along with her, and she was well liked by the children and adults participating in the program. Kasey had not previously interacted with
Ben, so her social interaction with him was neutral. In regards to following directions, Kasey was consistently compliant; she willingly completed any task given to her by an adult. From what I observed throughout the week, Kasey is more than capable of attending to an interesting task or activity for an extended period of time. According to her mother, Kasey does attend school on a regular basis and participates in extracurricular activities, including volunteer work. She readily volunteered her time to participate in the program.

Camper (Target Child) 2 Characteristics

Adam (pseudonym) is a 9-year-old male student who had completed the fourth grade before attending the second session (July 28 through August 1). He is diagnosed with autism and is nonverbal. Adam employs the following strategies: visual schedules, chewing gum, a weighted blanket or vest, and joint compressions. He can eat independently, but requires partial assistance when toileting and dressing. Adam has a tendency to elope, scream or yell, and scratch, bite or hit others and himself if he becomes excited or frustrated; if there is a change in his routine, Adam may become anxious or inflict self-injury. In his camp registration form, Adam’s grandmother informed us that he does not do well without prompting or a schedule.

Adam exhibits some emotional developmental delays. With help, he is able to request a break when he becomes upset, request assistance, and indicate his likes and dislikes. He does not express his feelings, indicate relaxation, or express confusion.

Adam is able to engage in solitary play independently. With help, he can take turns with his peers. However, he does not yet engage in parallel play, group play, or share materials with peers. His grandmother stated that Adam “will watch other children in or around his age group in a playground setting, but will not engage in active play.” He prefers to engage in independent play with electronic games and devices; he will watch his peers play games on a computer or iPad.

Delays in Adam’s communication are also present. Adam uses a schedule or communication cards, and may use sign language to communicate his wants or needs. At camp, he was using a communication device, but was still learning how to use it. “He does understand one- and two-step instructions” according to notes on his camp registration form. He can independently follow verbal directions within familiar routines, but does not consistently follow nonverbal directions. Adam does not yet call attention to others, or converse with peers and adults. He does require some processing time to follow directions, and can independently use pictures, signs, and other augmentative communication. With some assistance, Adam can make requests for his basic needs and wants, as well as follow verbal directions within novel activities and utilize visual supports to follow directions. Adam can make transitions, make choices, and wait when directed with some help.

Peer Mentor 2 Characteristics

Amy (pseudonym) is a 10-year-old female student who was selected to be Adam’s peer mentor during the summer program. Although the author was not able to interact with Amy during most of the program, the author was able to observe her personality and characteristics throughout the second camp session.

Through a number of group activities and games, Amy demonstrated good social skills and language, as well as the ability to engage in age-appropriate play skills. Amy was shy and tended to be quieter than the majority of her peers. Both her typically developing peers and the other campers displayed a neutral relationship toward Amy (she was neither well liked nor disliked by her peers). Amy did not have a social-interaction history with Adam or any of the campers participating in the program. She took direction well, and was compliant with adult directives. Amy seemed to enjoy the activities offered in the camp setting, and was able to attend to the tasks and activities presented to her without distraction. Amy’s parents informed us that she did not have a lot of prior experience working with children with special needs; she willingly volunteered her time to participate in the program.

Discussion

As previously mentioned, Table 1 was constructed in order to identify themes in the data collected throughout the camp program; themes across observations and across parent records were also examined. We found that students diagnosed with high-functioning autism tended to have a more successful outcome than those diagnosed with autism (only one student diagnosed with high-functioning autism experienced an unsuccessful outcome). In
addition, students who showed no signs of aggression benefited from the peer-mediated instruction and intervention strategies. Out of the four successful peer mentor relationships, only one student eloped. Despite exhibiting a characteristic that would normally cause an unsuccessful outcome, we contribute this student’s success to his peer mentor’s characteristics. In this particular case, the peer mentor remained with the target student even when the target student eloped from certain situations. In three out of the four successful pairs, the target student was able to imitate certain behaviors in social situations, allowing them to interact with their peer mentor in a meaningful and beneficial way. The peer mentors in the four successful pairings exhibited at least four of the five defining characteristics mentioned by Sperry et al. (2010); one mentor exhibited all five defining characteristics.

Through the summer program, we found that a number of factors should be taken into consideration before implementing a peer-mediated intervention aimed at improving the social-interaction skills of children with autism. As previously mentioned, several characteristics of both the target child and their peer mentor should be present; the target child and mentor should be matched according to their behavior traits and preferences in order to ensure the intervention will yield positive results. A successful outcome was determined by the number and type of social interactions between the child with autism and their typically-developing peer mentor throughout the week-long session. If the majority of interactions were initiated by the child or peer mentor, and the number of interactions increased throughout the week, the pairing was considered successful.

The target child is most likely to benefit from a peer-mediated intervention if they struggle in a group context, do not initiate or respond to social interactions, and display limited communication skills. In this particular study, Ben exhibited two of the three characteristics of a good target student (he did not show obvious signs of struggling in a group setting). Overall, Ben seemed to benefit from the intervention. Ben’s peer mentor, Kasey, exhibited the five defining characteristics of a successful peer mentor; she was a self-confident leader, was socially responsive to her peers, followed directions, was willing to participate, and had first-hand experience working with children with special needs. Their relationship was considered successful because there was a significant increase in the number of unprompted social interactions and engagements between the children throughout the week.

Because Ben exhibited the majority of the traits of a good target student and Kasey exhibited all the traits of a successful peer mentor, both students benefited from their time at camp. By the end of the week, Ben was more socially responsive to adults and his peers; he was more verbal than he had been at the beginning of the program. Ben was more willing to comply with adult instructions, and responded to verbal and nonverbal communication more frequently as the week progressed. Kasey also seemed to benefit from her interactions with Ben. She told us that she enjoyed working with Ben, and liked having the opportunity to assist children with special needs. When asked if she would attend camp again, Kasey indicated that she would like to participate in the program if given the opportunity.

The second target child mentioned in this study, Adam, exhibited all three characteristics of a good target student. However, he also exhibited several characteristics that may have negatively affected his relationship with his peer mentor. Adam displayed aggression, elopement, and was aversive to social interactions. Amy, Adam’s peer mentor, did not exhibit the majority of the defining characteristics of a successful peer mentor. Although Amy was willing to participate in the program and followed instructions given by adults, she was not a self-confident leader, did not have previous experience working with children with special needs, and was not as socially responsive to her peers due to her shy demeanor. Amy was physically much smaller than Adam; the difference in size may have adversely affected the peer-mediated intervention. Adam and Amy’s relationship was not beneficial, and was not considered successful for a number of reasons. Most importantly, there was not a significant increase in unprompted social interactions between the children. Throughout the week, Adam and Amy interacted with one another; however, the majority of their interactions were prompted by a behavior technician.

Although our findings were consistent with Sperry et al. (2010) in regards to the defining characteristics of a successful peer mentor, our findings were not consistent in regards to the defining characteristics of a target student who will benefit most from peer-mediated intervention strategies. Through observation during the program, we discovered that
there were three additional characteristics of the target student that should be taken into consideration when implementing this intervention. The intervention was unsuccessful if the student showed signs of aggression, elopement, or lacked the skills necessary to imitate others in a social context.

It is also important to note that the culture established in the classroom (and the overall culture of the school) may be an important factor in the success of peer-mediated interventions. In an elementary school setting, the teacher should establish a supportive and safe environment for all students, including those with special needs; if this environment is present, the peer-mentoring relationships will most likely be more beneficial for the students involved. Students should accept their peers and honor their unique qualities and characteristics, regardless of ability or disability.

**Conclusion**

Based on the data collected and observations taken during the summer program, it is evident that there are certain defining characteristics of students with autism—as well as their peer mentors—that contribute to the overall success of peer-mediated intervention strategies. One target student and peer mentor pair benefited from the intervention strategies implemented during camp, while another pair experienced no observable benefits. The students with ASD who benefited the most from peer-mediated interventions exhibited less aggression and self-injurious behavior, as well as the ability to follow one-step verbal directions. Because of the observations made by a behavior technician during the program, it can be concluded that great care should be taken when matching the students with autism to their typically developing peer mentors.

As previously mentioned, characteristics of both the student with autism and their peer mentor should be taken into consideration when developing and implementing a peer mentoring program in the classroom. Based on research (Gardner et al., 2014) and literature (Battaglia & Radley, 2014; Sperry et al., 2010), students who have limited communication skills, struggle in a group context, and do not respond to or initiate social interactions with their peers typically benefit most from these interventions. Research (Locke et al., 2014), literature (Battaglia & Radley, 2014; Sartini et al., 2013; Sperry et al., 2010), and direct observation during the camp sessions indicate that the following characteristics should be exhibited by the peer mentor in order to add to the success of the intervention: be able to follow instructions, be willing to participate, be self-confident leaders, be socially responsive to their peers, and have first-hand experience working with children with special needs.

**Implications**

Peer-mediated intervention strategies based on principles of behaviorism and social learning theory are aimed to improve the social skills and increase the number of social interactions between students on the autism spectrum and their typically developing peers (Bandura, 1977; Gardner et al., 2014; Sperry et al., 2010; Wilkes-Gillan, 2014). The main focus of the intervention is to systematically and explicitly teach typically developing peers strategies to successfully engage students with ASD in positive social interactions (Sperry et al., 2010). Through peer mentoring programs, typically developing students “were more likely to be connected to children with ASD” and “maintained a strong and positive role within the classroom” (Locke et al., 2012, p. 1895).

**Limitations and Recommendations**

As is the nature of research studies, there were factors that the researchers could not control that may have affected the outcome of this study. It is difficult to provide a truly authentic environment for students; although the setting was similar to a typical elementary classroom, it was not possible to replicate the exact environment to which each student was accustomed. Although the students that participated in the program were around the same age, there was an age range during both sessions. In an elementary classroom, there would not be as large of an age gap between students. This factor may have impacted the outcome of the study.

It is also important to note the size of the sample for this study. Data were collected on 11 pairs out of a total of 20 pairs that participated in both sessions; in order to draw more accurate conclusions, the study should be replicated with a larger sample size.

The time constraint of a five, four-hour sessions may not have been enough to gauge the overall success of the peer-mediated intervention strategies employed during the program. In order to accurately examine the meaningfulness of the peer relationships, the peer
mentoring strategies should be implemented throughout an extended period of time (perhaps over an entire quarter or semester in an elementary school setting).

**For the Classroom**

Peer mentoring is a viable intervention for teachers to use in the inclusive classroom setting. Teachers should take care in matching students with autism with their peer mentors; a number of characteristics and traits of both students should be taken into account. The role of the teacher is to facilitate interactions among the students. Peers must be explicitly taught how to be a successful peer mentor, as well as given a clear definition of their role as a mentor. Ongoing feedback on facilitating social relationships is crucial for both the teacher and peer mentors.

**For Future Research**

Recommendations for future studies include defining the characteristics of the target child that contribute to the outcome of peer-mediated intervention strategies. Researchers should focus on contributing variables including (but not limited to) elopement, aggression, and the target student’s ability to imitate others in a social setting. Future research should examine the effectiveness of peer mentoring strategies on: 1) promoting social interactions between children with autism and their typically developing peers, and 2) improving the target child’s ability to establish and maintain social interactions and relationships with their peers.

**References**


