

AN ABSTRACT OF THE THESIS OF

Laia C. Robichaux for the degree of Master of Science in Science Education presented on April 25, 2011.

Title: Gender and Science Identity and the Visitor Experience: Looking Closely at Aquarium Visitors

Abstract approved:

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In recent years, there has been an increased focus on identity and how it shapes visitor experience in free-choice learning (FCL) environments. Inquiry into how visitor's sex impacts identity and experience has yielded equivocal results. To date there has been no research into how the psychosocial construct of gender and gender identity influence visitor identity, experience, and science identity. This thesis set out to discover possible connections between and individual's visitor experience, visitor identity, free-time science activities, and science identity through the gender identity lens. The study took place at the Oregon Coast Aquarium in Newport, Oregon. The Personal Attributes Questionnaire (PAQ) was used to measure gender identity, and interviews were conducted to determine visitor experience, visitor identity, and science identity based on free-time science activities engaged in by the participants. Raw PAQ scores were statistically analyzed within the study population using standardized scores, which were

then applied to the coded interview data. Links and “hints” were noted based on this analysis, and hypotheses for future research were formulated based on this data. Gender identity emerged as a useful construct that could broaden the FCL field’s ability to understand the complexity of the visitor experience and explain some of the equivocal findings about traditional influences of sex in such settings. Although science identity did not emerge as an important variable, there are likely conceptual and measurement issues affecting these findings. The information gathered here and applied to research in the future, both in school and FCL settings, could lead to a deeper understanding of why there is still a gender gap in many science, mathematics, engineering, and technology fields.

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Gender and Science Identity and the Visitor Experience: Looking Closely at Aquarium
Visitors

by

Laia C. Robichaux

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APPROVED:

Major Professor, representing Science Education

Chair of the Department of Science and Math Education

Dean of the Graduate School

I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Laia C. Robichaux, Author

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CONTRIBUTION OF AUTHORS

Dr. Dierking assisted with the design and writing of this paper, and with the science identity data analysis. Dr. Enochs assisted with the statistical analysis of the data.

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DEDICATION

This thesis is dedicated to Thomas Joseph “Buddy” Robichaux Sr. for all of the support and inspiration he provided. Through good times, bad times, indecision and life changes, he never wavered with your love or encouragement, even when he didn’t understand what or why.

Pops, you would have loved this.

Gender and Science Identity and the Visitor Experience: Looking Closely at Aquarium Visitors

Chapter 1: Introduction

Museums and aquariums have long been considered valuable learning centers and community assets (Falk & Dierking, 2002; Scott, 2006), serving as important institutions in which people pursue free-choice learning (FCL) interests that are voluntary, self-directed and occur when individuals have primary responsibility for determining the what, when, where, why, how and with whom of learning. Some museum researchers posit that because of their free choice nature, visitors in these settings may be better able to naturally express and enact their identities than in the externally “prescribed” settings of work or school. Some researchers even suggest that identity-building and enacting are the primary reasons for visiting such institutions and that building identity may actually be an outcome of such visits, rather than merely a mediating factor.

However, identity is a complex construct. In part it is reflected in a person’s behavior (Kozoll & Osborne, 2004), but also is shaped by his/her beliefs, goals, and values (Kozoll & Osborne, 2004; Pugh, Linnenbrink-Garcia, Koskey, Stewart, & Manzey, 2009). In addition, socially constructed racial, ethnic and gender identities all influence a person’s overall identity and thus his/her learning (Carlone & Johnson, 2007). Identity is also shaped by other factors: the individual’s self-efficacy and his/her perceived sense of competence performing specific tasks or understanding a particular discipline (Bleeker & Jacobs, 2004). These elements of identity are dynamic and contextual, not static. For example, an individual’s identity can change over time and is uniquely influenced in different contexts (Carlone & Johnson, 2007). This

dynamism creates unique experiences in which the individual constructs and enacts his/her identity.

Evidence points to the importance of the individual and how s/he uses the resources available in a free-choice learning institution to shape, reinforce, or enact identity. Given the free-choice, personal and idiosyncratic nature of such settings, they are potentially ideal laboratories in which to explore various forms of identity and its influence on learning. Two specific types of identity which are explored in this study are gender identity and science identity.

Defining Gender Identity

For much of the history of the psychological study of gender, it was conceptualized on the same dipole scale as biological sex, with femininity being associated with women/girls and masculinity associated with men/boys (Ashmore & Sewel, 2004). Recent studies of individual gender identity, however, have found that many people possess a medley of characteristics that represent Western standards of masculine and feminine (Koestner & Aube, 1995). Conclusions from these studies suggest that: “Gender, though sometimes related to biological sex, is a socially constructed continuum of personal identities that people adopt as a way of life” (Curran & Warber, 2008). For example, a person can choose to conform to societal gender norms appropriate to his/her biological sex, or choose non-conformity and even conformity with the social gender norms of the opposite biological sex (Mahalik et al., 2005, 2003). This conformity/nonconformity with one’s biological sex is what shapes and defines a person's gender identity. This is critically important to understand in the realm of science education, since there is evidence that if a science activity is not in line with a person’s gender

identity, that person, , especially if female, is less likely to participate in it, or is more likely to try to modify it to better fit their current gender identity (Brickhouse & Potter, 2001).

Defining Science Identity

How an individual perceives him/herself in relationship to both the discipline of science, as well as its practice, is an important consideration when studying how people learn in free-choice settings; this construct is referred to as science identity (Kozoll & Osborne, 2004). The National Research Council publication, *Learning science in informal environments: People, places, and pursuits*, identifies six key strands of science-specific learning that can be supported in free-choice learning arenas. The sixth strand states that learners in informal environments may “think about themselves as science learners and develop an identity as someone who knows about, uses, and sometimes contributes to science” (Bell, Lewenstein, Shouse, & Feder, 2009). People who are intrinsically motivated toward science, engage in science-related experiences and programs, and receive social encouragement from friends and family to participate, are generally said to have a science identity (Carlone & Johnson, 2007). Evidence suggests that those who do identify with science are more successful during science learning experiences (both in school and out of school) than individuals who do not identify.

Although research documents that what a person learns in science-related FCL environments, is influenced by their identity as both a gendered individual and a science learner, research results are equivocal. Some studies indicate strong effects as a function of sex and others show no effect at all or unanticipated and sometimes ambiguous effects. One possible explanation may be the fact that self-report measures of biological sex, or the researcher's visual

assumption of biological sex used in many studies, are based on the traditional dipole scale, rather than on a more enlightened view of gender identity (Curran & Warber, 2008). When one adds the layer of science identity to the context, the picture becomes even more complex.

Purpose of Study

A more nuanced view of gender and its relationship to science identity has not been applied nor studied extensively in free-choice learning settings. Consequently, little is known about whether, and if so how, these factors influence and shape visitor experiences and learning. This hypothesis-generating study attempts to fill this gap. Three research questions guided data collection and analysis:

- Is there a connection between an individual's gender identity and their experience in a free-choice learning environment such as an aquarium? If so, how does gender identity influence visitor perceptions of these experiences?
- Is there a connection between an individual's science identity and their experience in a free-choice learning environment such as an aquarium? If so, how does science identity influence visitor perceptions of these experiences?
- Is there a connection between a person's gender identity and their science identity? If so, how does this interaction influence visitor perceptions of these experiences?

Findings expand the study of gender in free-choice learning settings such as aquariums and museums. Most importantly, the study begins to explore visitor perceptions of FCL experiences in aquariums and possible relationships between a person's gender and science identity, as well as the influence of these identities on their science learning experience while visiting.

Chapter 2: Literature Review

The Visitor Experience & Identity

Research in free-choice science learning suggests that most people seek to satisfy some part or parts of their identity when they engage in FCL experiences during their leisure time (Falk, 2006; Falk, Heimlich, & Bronnenkant, 2008; Falk, 2008a, 2008b, 2009; Falk, Koke, & Dierking, 2009; Falk & Storksdieck, 2010). For example, adults visit settings such as national parks, science centers and botanical gardens to satisfy their intellectual curiosity and stimulation, as well as to fulfill their need for relaxation, enjoyment and even spiritual fulfillment (Ballantyne and Packer, 2005; Brody, Tomkiewicz and Graves, 2002; Doering and Pekarik, 1996; Falk, 2006; Heimlich et al., 2005; Gammon, 1999; Kaplan and Kaplan, 1982; Moussouri, 1997; Pekarik, Doering and Karns, 1999). Adults take their children to such settings because they feel these experiences are worthwhile, educational and fun, and that they and their children learn science together in the process (Borun et al., 1996, 1997; Dierking, et al., 2000; Dierking and Falk, 2003; Falk and Dierking, 1992; Rounds, 2004). Some interesting work in recent years regarding empirical approaches to studying visitor identity in FCL settings has been undertaken.

In a series of studies conducted in several Smithsonian museums, Pekarik, Doering and Karns (1999) specifically investigated visitor satisfaction, and the museum features contributing most to a satisfying experience as a way of looking at identity with an assumption that satisfying experiences are those that build and reinforce identity. Findings from these studies suggested four primary types of experiences that museum visitors reported having that most contributed to their satisfaction with a visit, with several subcategories for each type. They are:

Object Experiences

Seeing “the real thing”

Seeing rare/uncommon/valuable things

Being moved by beauty

Thinking what it would be like to own such things

Continuing my professional development

Cognitive Experiences

Gaining information or knowledge
Enriching my understanding

Introspective Experiences

Imagining other times or places
Reflecting on the meaning of what I was looking at
Recalling my travels/childhood experiences/other memories
Feeling a spiritual connection
Feeling a sense of belonging or connectedness

Social Experiences

Spending time with my friends/family/other people
Seeing my children learning new things
(Pekarik et al., 1999)

The type of experience that contributed to visitor satisfaction differed depending on a number of factors, including the type of museum visited (art versus science, for example), the sex of the visitor, and whether s/he was a new or repeat visitor to a particular museum/exhibition (Pekarik et al., 1999). In terms of sex differences, males visiting a science museum were more likely to describe that an experience with objects contributed to it being a valuable experience to them, whereas females were more likely to describe opportunities for introspection.

Another approach to unpacking identity has taken a situated perspective to visitor motivations (Falk, 2009). In one study for instance, Falk, Heimlich, and Bronnenkant (2008), explore the situated identities of visitors to two zoos and two aquariums, and how these identities influence visitors' cognitive experiences in these settings. Five categories of identity-related visitor motivation were identified in this study:

- “Explorers” are curiosity-driven with a generic interest in the content of the museum. They expect to find something that will grab their attention and fuel their learning.

- “Facilitators” are socially motivated. Their visit is focused on primarily enabling the experience and learning of others in their accompanying social group.
- “Professional/Hobbyists” feel a close tie between the museum content and their professional or hobbyist passions. Their visits are typically motivated by a desire to satisfy a specific content-related objective.
- “Experience Seekers” are motivated to visit because they perceive the museum as an important destination so their satisfaction primarily derives from the mere fact of having “been there and done that.”
- “Spiritual Pilgrims” are primarily seeking to have a contemplative, spiritual and/or restorative experience. They see the museum as a refuge from the work-a-day world (Falk et al., 2008).¹

In independent work Packer and Ballantyne (2002) have reinforced and enhanced understanding about identity-related motivations. In one investigation across three sites, they found that both personal goals and situational characteristics influenced visitors’ motivational factors. For example, aquarium visitors were more interested in social and restorative goals, whereas visitors to a museum and an art gallery rated learning and discovery goals above social and restoration goals. Packer expanded on this work by recognizing four aspects of the visitor experience (Packer, 2008) that are intertwined and important. These four aspects include that “...recreational *activities* (such as a museum visit) are undertaken in a *setting* that has particular attributes; in order to *experience* certain consequences; and so derive desired *benefits*” (Packer, 2008). Interestingly, Packer used the Pekarik, et., al. (1999) visitor experience categories (object, cognitive, introspective, and social) to describe museum visitors’ preferred experiences and looked more deeply at their relationships among a variety of visitors. She found that restorative aspects of museum visits were more important to local residents than tourists, and

¹ In later work Falk refined this category and now calls it “Recharger.” These categories, along with two additional ones, *Respectful Pilgrims*, visiting out of a sense of duty or obligation to honor the memory of those represented by an institution/memorial and *Affinity Seekers* visiting because a particular institution, or exhibition, speaks to a visitor’s sense of heritage and/or self, form the basis of his Identity-Related Visitor Experience Model” (Falk, 2009).

these introspective experiences were frequently (70%) mentioned in conjunction with object or cognitive experiences (Packer, 2008).

Sex Differences in Free-Choice Learning Settings

The study of whether, and if so how sex differences influence visitor behavior and learning in free-choice settings such as museums has been an area of research interest for decades. In a comprehensive literature review on the topic, Diamond (1994) cites a study conducted in 1956, in which it was observed that boys spent more time in the Children's Gallery of a London museum than girls (Brooks & Vernon 1956).

Sex differences continue to be of interest as research in the field of free-choice learning (FCL) has grown. One line of research investigates the interaction between children and their parent(s) in science-related activities. In a study conducted with high-ability students (determined by an IQ of 130 or greater and high scoring on the Stanford Achievement Test) age 9 to 13, Joyce and Farenga (1999) found that young boys seemed to be encouraged to foster an early interest in science and exploratory thinking, while young girls were not. Similarly, during shared science tasks, parents seem to use more scientific language when working with sons than daughters, particularly in the physical sciences (Tenenbaum & Leaper, 2003). For instance, in one study researchers found that “boys were three times more likely than girls to hear explanations from their parents” (Crowley, Callanan, Tenenbaum, & Allen, 2001).

There are also several studies in which differences were observed in parental behavior toward sons and daughters, while interacting with museum exhibitions (Diamond, 1994). These studies showed that mothers primarily interacted verbally with children, but when fathers did chime in their talk was aimed more at their sons. In another review of the literature on gender

and learning in science museums, Taylor (2002) noted that there are noticeable differences in the ways that males use exhibitions when compared with females. Males interacting at an exhibit together often turn the experience into a competition, whereas females engage in social interactions that Taylor considered “as important a part of the experience as the actual interaction with the exhibit” (2002). Similarly, boys tend to interact more with exhibitions that are gender-role specific (Diamond, 1994). McManus found that males often assumed a dominant role, choosing what exhibitions to look at and engaging sons in conversations, while females tended to engage in more care-taking activities.

Sex differences are also evident in some studies focusing on multimedia use among museum visitors. When evaluating visitor use of interactive videodisks (IVDs) in a museum exhibition about endangered birds in Michigan, Morrissey (1991) found that there was a significant difference in use as a function of sex for both adults and children. Groups with boys were more likely to use the IVDs than those with girls, groups with both sex adults were more likely to engage with the exhibit if they were accompanied by a male child, and adult males were less likely to engage if they were with a female child than with a male child (Morrissey, 1991). Interestingly, there are also studies that suggest that the influence of sex is not so easily discerned or perhaps is more complex and nuanced than some of these previously cited studies suggest. For example in a tracking study of families in a natural history museum, Dierking (1987) found no significant sex differences between parents interacting with sons and daughters. In fact, her results suggested that fathers tended to interact similarly with daughters and sons, while it was mothers who varied their behavior, tending to be more exhibition focused with sons than with daughters. When measuring the development of positive attitudes toward science in school groups visiting a museum, Finson and Enochs (1987) concluded “students who visited the

museum developed more positive attitudes toward science and technology than non-visiting students, regardless of sex.” Such equivocal findings have also been found in studies of multimedia use among museum visitors. In a study of an interactive computer program in an exhibition about the archaeological expedition that discovered Euesperides, the researcher found that females and males were equally likely to use the technology provided, and that female users actually spent more time with the exhibitions than males (Economou, 1998). The equivocal nature of the results from all of the studies suggest that perhaps there is something more complex and nuanced happening that is not being captured in a valid and reliable fashion by the current method of biological sex differentiation.

Measuring Gender Identity

The intricate mix of personal and societal influences on gender identity makes this a subject that is challenging to study. However, a number of tools have been designed and tested to assess levels of masculine and feminine traits, social interactions, gender attitudes, and sex-roles. Two of the most well-established instruments are the Bem Sex-Role Inventory (BSRI) developed by Sandra Bem in the 1970s (Bem, 1974), and the Personal Attributes Questionnaire (PAQ) developed by Janet Spence (Spence, 1993). The 24-question PAQ has a demonstrated history of validity and reliability in gender assessment (Koestner & Aube, 1995; Robinson, Shaver, & Wrightsman, 1991; Spence, 1993; Spence & Buckner, 1995). In terms of measuring gender attitudes, the Attitudes towards Women Scale (AWS) (Spence, Helmreich, & Stapp, 1973) and the Gender Attitude Inventory (GAI) (Ashmore, Del Boca, & Bilder, 1995) have both been used to assess an individual's views on social stereotypes. The conformity to masculine norms inventory (Mahalik et al., 2003) and the conformity to feminine norms inventory (Mahalik

et al., 2005) are also two recent gender assessment instruments that attempt to measure conformity to traditional sex roles.

Although the PAQ was developed in the late 1970s, it was selected for this study for a number of reasons. It has been tested numerous times for both validity and reliability and has consistently been found to be both highly valid and reliable (Koestner & Aube, 1995; Robinson, Shaver & Wrightsman, 1991; Spence, & Buckner, 1995; Spence, 1993; Spence & Helmreich, 1978). Since it is a measure of androgyny, the tool has survived well through changing times, including the rise of feminism and greater equality between the sexes. Also because it has been used so extensively, the PAQ has been reduced to the core elements necessary for determining an individual's level of androgyny, thus is only a 24-question instrument. This makes it fairly easy to administer to large groups and/or under circumstances with time constraints, such as interviewing FCL visitors, for example, vacationers at an aquarium. While Mahalik's (Mahalik et al., 2005; 2003) conformity to masculine and feminine norms inventories may one day supplant the PAQ, they are currently too lengthy for practical use in FCL field conditions in which time sensitivity is so critical.

Chapter 3: Methodology

The questions being explored in this hypothesis-generating study are the following:

1. Is there a connection between an individual's gender identity and their experience in a free-choice learning environment such as an aquarium? If so, how does gender identity influence visitor perceptions of these experiences?
2. Is there a connection between an individual's science identity and their experience in a free-choice learning environment such as an aquarium? If so, how does science identity influence visitor perceptions of these experiences?
3. Are there connections between a person's gender identity and their science identity? If so, how does this interaction influence visitor perceptions of these experiences?

This qualitative study investigated visitor perceptions of their experience and science identity through the lens of gender identity among a small sample of visitors to the Oregon Coast Aquarium. The primary goal of the study was to see if any connections or correlations emerged when an individual's gender identity was used as a filter through which to assess his/her visitor experience and science identity.

Research Setting

This research study was conducted at the Oregon Coast Aquarium located in Newport, Oregon; the aquarium is situated on the south side of the Yaquina Bay. It contains both indoor and outdoor exhibitions. All of the outdoor exhibitions are permanent, and include turkey vultures, sea otters, sea lions, an octopus, a nature trail/estuary overlook, and a walk-in sea bird aviary. There are two main areas of permanent exhibitions indoors. The first is comprised of a series of three rooms, Coastal Waters, Rocky Shores, and Sandy Shores, which are a progression of the very near shore, intertidal environment and animals of the Pacific Northwest coastline.

The Rocky Shores environment has a volunteer-staffed touch pool in addition to traditional displays, where visitors can touch and explore native invertebrates such as giant green anemones and abalones. The second permanent exhibition indoors is a series of three tunnels, called Passages of the Deep that display the fauna from Oregon's southern coast. This exhibition is known colloquially as the "shark tunnels." In addition to these permanent exhibitions, the aquarium has a large indoor changing exhibition gallery, with new exhibitions being installed every couple of years (on average). The exhibition present during this study was Swampland, which depicts animals from three distinct types of swamps. The exhibition opened to the public on May 28, 2010.

During the time of this research study, the aquarium also had several special programs in place. On three of the days, youth volunteers set up a temporary "animal cart" in the aquarium lobby. For two of these days the cart included artifacts from both sharks and marine mammals, and on the other day only the mammal artifacts were displayed. These items were available to be touched by visitors, and the youth volunteers provided additional information. The month of August was also "Shark Month" at the aquarium, and several special events were scheduled. These included a "Shark Station" in the conference room in the Passages of the Deep building, face painting on Saturdays, diver shows in the shark tank of Passages of the Deep, and special showings of a Jean-Michele Cousteau documentary in the theater.

The aquarium provided a six-foot table and two chairs for data collection. Data was collected at one of the entrances to the Local Ocean Café located in the lobby, and directly across from the small coffee cart.

Instruments

Two instruments were used to collect data in this study. The 24-item Personal Attributes Questionnaire (PAQ) (Spence & Helmreich, 1978) was used to determine the unique gender identity of each individual in the study and was the first thing filled out by the study participants. Each participant had their own copy of the PAQ to write on, with instructions provided at the top of every sheet. Supplemental instructions on completing the PAQ were provided to participants as needed. See Appendix A for a copy of these materials.

The PAQ has three subscales, Masculine (M), Feminine (F) and Masculine-Feminine (M-F). The M-subscale measures characteristics that are viewed as more common in society among men but are not undesirable in women. For example one of the characteristics in this subscale is independence, with “very independent” being highly masculine and “not at all independent” not masculine. The F-subscale measures characteristics that are viewed as more common in society among women but are not undesirable in men, such as kindness, with “very kind” being highly feminine and “not kind at all” not feminine. It is important to note that in terms of these two subscales, the “not masculine” end of the scale does not equate with feminine, and likewise the “not feminine” end of the scale does not equate with masculine. The M-F-subscale measures characteristics that are viewed as more desirable in one sex but are undesirable in the other. An example for this subscale is aggression. “Very aggressive” is a highly masculine characteristic, with its counterpart “not at all aggressive” viewed as a highly feminine characteristic. In the 24 item PAQ used for this study, each of these subscales uses 8 paired characteristics to determine the person’s gender identity.

After completion of the PAQ, study participants were asked a series of ten to eleven open-ended interview questions, developed by the researcher specifically for this study (the

interview protocol is in Appendix B). Development of the interview questions was based on grounded theory, which allows for the adaptation of research questions through the data collection process. All clarifications and additions were noted on the master list of interview questions kept by the researcher. The interview questions were formulated with the assistance of a leader in the field of free-choice learning and visitor experience research. The flexible nature of grounded theory allowed for refinement as the research progressed to maximize validity and reliability. The first three questions explore the participant's science identity and the remainder allows the participant to describe his/her perceived experience at the aquarium on this visit specifically.

Sampling Procedure

The sampling procedure for this study was a semi-random, convenience sample. Visitors who had finished their visit for the day (they were exiting the exhibition area of the aquarium but not the aquarium itself) and were age 18 years or older were recruited in the main lobby of the aquarium. Visitors were approached and those agreeing to participate were directed to the research table.

Visitors dealing with crying or screaming children, part of a scheduled tour group, or talking on cell phones, were not approached for recruitment. This decision was made before sampling began and was maintained throughout the data collection process. Beyond these criteria, visitors of all ages, ethnicities and sexes were included in the sample. Every third group of visitors matching the above criteria was approached and offered a chance for one member to participate in the research study. If no one in the group wanted to participate, the next available

group was approached and a participant recruited. After the participant had finished, the process of random selection was begun again.

Data Collection

Data collection for this study was conducted over a two week period starting on Monday, July 26, 2010 and concluding on Saturday, August 7, 2010. Data was collected every third day starting on the 26th over a course of five days, and a total of 6 participants were recruited per day. PAQs and interviews were completed at the far end of the lobby from the admissions desk to minimize distractions to participants, and so that other aquarium visitors were not inconvenienced. The researcher also provided marine-themed coloring sheets and crayons for participants with small children. This was done in order to provide a quiet distraction for the children while their parent completed the questionnaire and interview. Children were allowed to take their coloring sheets home with them.

The Personal Attributes Questionnaire (PAQ) was distributed to each study participant with the following written instructions:

The items below inquire about what kind of person you think you are. Each item consists of a PAIR of characteristics, with the letters A-E in between. For example,

Not at all artistic A....B....C....D....E Very artistic

Each pair describes contradictory characteristics – that is, you cannot be both at the same time, such as very artistic and not at all artistic.

The letters form a scale between the two extremes. You are to choose a letter which describes where YOU fall on the scale. For example, if you think that you have no artistic ability, you would choose A. If you think that you are pretty good, you might choose D. If you are only medium, you might choose C, and so forth” (Spence, Helmreich & Stapp, 1973).

Visitors typically took one to two minutes to fill out the PAQ, but there was no time limit enforced by the researcher. Only a few visitors needed more explanation than what was printed on the sheet for filling out the PAQ, and in all of these cases a quick oral recitation of the instructions was sufficient to ease their insecurities. While participants were filling out their PAQ, the researcher remained silent unless directly queried by the participant in order to limit outside distractions.

Answers to interview questions were audio recorded for accuracy and to allow the researcher to assume a more conversational manner with the understanding that details of answers could be filled in after the interview. During the interview, participants were also asked to trace their route through the aquarium on the officially produced map of the aquarium. Each participant was provided with a clean copy of the map and were allowed to write on their copy if they so chose. Clarifications about where certain exhibitions were located on the map were provided on an as-needed basis.

Ethical Considerations

The methods and study instruments used in this study were approved by OSU's Institutional Review Board (IRB). Since this study focused on adults aged eighteen or older, signed consent was not required of participants. Each person was presented with a one-half page informed consent document for their records, prior to their participation in the study (Appendix C). Full permission to conduct this research at the Oregon State Aquarium was obtained during the planning stage of this research.

Chapter 4: Results

Study Participants

Twenty-eight research participants were recruited for the study and were visitors to the Oregon Coast Aquarium who had completed their visit for the day. Fifteen were women and thirteen men. All were age 18 or older. Ten were visiting with their spouse and children, 11 with only their spouse, 4 were visiting with friends, 1 was visiting with parents and spouse, and 1 was visiting with her parents and siblings. Twenty-seven of the 28 participants resided in the United States and at least 5 lived in Oregon. In addition, one visitor was from each of the following states: Kansas, Florida, Idaho, Washington, Illinois, and California; the one international visitor was visiting from Alberta, Canada. The rest of the participants did not identify their home during their interviews. None of the Oregon residents were from the Newport, Oregon area. Although sex demographics were not taken during the study, a list of visitor's sex as determined visually by the researcher is included in Appendix D.

Data Analysis

Personal Attributes Questionnaire (PAQ)

After the PAQ data was collected for this study, participants' responses were scored using the protocol established by Spence et al. (1973). Individual characteristics are scored from 0 to 4. For the M-subscale and F-subscale the characteristic that is viewed as more common in society for a male or female is scored 4, and the characteristic that is not common is scored 0. For the M-F-subscale the desirable masculine trait is scored 4 and the desirable feminine trait scored 0 (since this subscale measures characteristics that are viewed as more desirable in one sex than the other, when this scale is scored 4 for the desirable masculine trait that end of the

scale also represents an undesirable feminine trait; likewise when the desirable feminine trait is scored 4, that end connotes an undesirable masculine trait). There are 8 paired characteristics in each of the three subscales so each subscale has a possible score of 32 points.

After each subscale in the PAQ was scored, the mean and standard deviation were calculated. These values were then used to assign each study participant a standard score for each of their PAQ subscales. The standard score (or z score) was calculated using the following formula:

$$Z = (x - \mu) / \sigma$$

The x is the raw score to be standardized, μ is the mean of the population, and σ is the standard deviation of the population. Standard scores were calculated using the formula in Excel. This was done to so that comparisons could be made within these subscales based on how each individual's z score varied from the mean score of the population.

Interviews

Interviews were transcribed by the researcher and coded into categories. The data for the visitor experience (preferred type of experiences and identity-related motivations) and science identity were coded and analyzed separately. The interview items of particular interest for understanding the visitor experience were those exploring research participants' reasons for visiting that day and their perceptions of the experience including the following:

- What are some of the things you like about visiting museums, zoos, aquariums? (experience type);
- Why did you decide to come to the aquarium today? (visitor identity);
- Why were you particularly drawn to [your favorite] exhibition(s) today? (why favorite);
- What was your favorite part of your whole visit? (whole visit);

- Is there anything else you'd like to add? (final comments).

These questions were independently coded using two coding systems based on well-documented visitor experience literature described earlier. Preferred type of experience, why drawn to particular exhibitions and favorite part of the whole visit were coded using the categories defined by Pekarik, Doering and Karns (1999): object, cognitive, social, and introspective experience. Responses for the visitor identity question were coded using Falk's (2009) identity-related visitor motivation categories: explorer, experience seeker, facilitator, professional/hobbyist, and recharger. Questions could be coded in more than one category if appropriate.

Science identity was determined by coding interview items probing science-related activities, careers and hobbies, as well as comparing with appropriate items on the instrument, *Is science me?* (Aschbacher & Roth, 2010), which measures science engagement, attitude, competence and career aspirations.

Findings

PAQ-Masculine Subscale

The mean value for the masculine (M) subscale in this study was 20.25, with a standard deviation of 3.4808 within the study population. The three highest standardized (Z) scores are 1.6519 (2 participants), 1.0773 (1 participant) and 0.7900 (4 participants) who represent 25% of the total study population. The lowest Z scores were -1.5083 (2 participants), -1.7956 (1 participant), and -2.0828 (1 participant); this 14% of the study population. A score of 0 on this subscale represents an androgynous, non-masculine person.

PAQ-Feminine Subscale

The mean value for the feminine (F) subscale of the PAQ in this study was 23.32, with a standard deviation of 3.2520 within the study population. The three highest Z scores are 2.6687, 1.7462, and 1.4387, with one participant each representing 11% of the study population. The lowest three scores are -0.1424 (3 participants), -1.3289 (2 participants), and -1.9439 (1 participant), for a total of 21% of the study population. A score of 0 on this subscale represents an androgynous, non-feminine person.

PAQ-Masculine-Feminine Subscale

The mean value in this study for the masculine-feminine (M-F) subscale is 14.25 with a standard deviation of 3.7379 within the study population. The three highest scores for this subscale are 2.8759 (1 participant), 1.2707 (1 participant), and 1.0032 (5 participants). This subpopulation represents 25% of the study population. The three lowest scores are -1.137 (2 participants), -1.4045 (1 participant), and -1.9396 (1 participant), representing 14% of the study population. A score of 16 on this subscale represents an androgynous individual so on this subscale there was a tendency toward the masculine.

A compilation of Z scores for each subscale is in Table 1.

Table 1. Standardized z scores on PAQ for entire study population

Participant #	M-F Score	M-F Standardized Score	M Score	M Standardized Score	F Score	F Standardized Score
0726A	12	-0.6019352	21	0.21546679	25	0.51617195
0726B	19	1.27075219	22	0.50275585	21	-0.7138548
0726D	18	1.00322541	23	0.79004491	19	-1.3288682
0726E	17	0.73569864	18	-0.6464004	20	-0.1424196
0726F	18	1.00322541	23	0.79004491	21	-0.7138548
0729A	18	1.00322541	13	-2.0828457	17	-1.9438816
0729B	9	-1.4045156	20	-0.0718223	21	-0.7138548
0729D	14	-0.0668817	22	0.50275585	28	1.43869203
0729F	7	-1.9395691	15	-1.5082676	27	1.13118534
0729G	13	-0.3344085	21	0.21546679	32	2.66871881
0729H	15	0.20064508	23	0.79004491	24	0.20866526
0801A	11	-0.869462	16	-1.2209785	24	0.20866526
0801B	18	1.00322541	23	0.79004491	20	-1.0213615
0801C	10	-1.1369888	22	0.50275585	27	1.13118534
0801E	13	-0.3344085	20	-0.0718223	23	-0.0988414
0801F	12	-0.6019352	26	1.65191209	24	0.20866526
0804A	14	-0.0668817	24	1.07733397	22	-0.4063481
0804B	10	-1.1369888	16	-1.2209785	24	0.20866526
0804C	13	-0.3344085	15	-1.5082676	20	-1.0213615
0804D	18	1.00322541	26	1.65191209	24	0.20866526
0804E	16	0.46817186	22	0.50275585	24	0.20866526
0804F	14	-0.0668817	19	-0.3591113	23	-0.0988414
0807A	14	-0.0668817	23	0.79004491	25	0.51617195
0807B	12	-0.6019352	22	0.50275585	22	-0.4063481
0807C	12	-0.6019352	19	-0.3591113	24	0.20866526
0807D	25	2.87591286	22	0.50275585	29	1.74619872
0807E	15	0.20064508	14	-1.7955566	24	0.20866526
0807F	12	-0.6019352	17	-0.9336894	19	-1.3288682
Mean	14.25	Mean	20.25	Mean	23.3214	
STDV	3.737944	STDV	3.48081	STDV	3.25196	

Visitor Experience

As defined by the Pekarik, Doering and Karns (1999) categories, “Object” experiences were preferred by 68% of the sample when visiting museums, zoos, and aquariums. Participants expressed this preference by specifically discussing experiencing and viewing the aquarium as a whole, viewing particular exhibitions or animals, and viewing and experiencing rare, unusual, and/or new things. Object experiences were described by visitors in two distinct manners, either generally or specifically. Responses included:

“Oh, there are certain animals I tend to go for, like the jellyfish. And I was really looking for cuttlefish, but I didn’t see them today” (participant 0804B).

“Oh, the Sea Lions are always a favorite, everywhere we go. And, um, the shark tunnels were just amazing...It’s amazing to see them up close, the way they swim, to get to see the different views of their body. Just the way they’re put together and how they move” (Participant 0801A).

“Well, I like the habitat-oriented exhibits where they divide the different habitats up and you can see the animals in their different habitat” (Participant 0807A).

Cognitive experiences are those involving personal learning objectives and were preferred by 54% of the sample. Examples include:

“Umm, always loved science, umm, very interested in, ,uh, natural science and just enjoy learning about, you know, seeing the animals and learning about the animals” (participant 0726D).

‘Love the Sea Lions and Seals ‘cause they were playing when I was there. And, at the Turkey Vulture there was a lady explain[ing]—they were there to feed them but they stopped to explain why they had the two, what they fed them, how they took care of them’ (Participant 0804F).

“Hmm, a bunch of different things, I mean not just sharks or sea lions or anything like that. A lot of the people were really helpful...the uh, um, the volunteers, they helped out a lot, which was good. Learning, they had a lot of learning things. Um, the, uh, the diagrams, things like that, where you could read about them. So yeah, and like I said the volunteers were really helpful” (Participant 0801C).

Social experiences are defined by spending time with others interacting and/or watching others (usually children) learn. These types of experiences are enjoyed by 25% of the sample.

Examples of how this category was expressed include:

“It’s fun with the kids” (Participant 0804D).

“Um, the acrylic tunnels, liked those a lot...The interactive part of it with not only myself being able to see but watching the other people and kids playing in there” (Participant 0729G).

“Favorite part was that my boy actually was excited to go and move on to the next thing and see them and not like “no I don’t want to see that” or “mommy carry you? Or me” he just, he’s excited to go see everything” (Participant 0807F).

The final category is introspective experiences which can include remembering past events during a visit, visiting primarily for relaxation or rejuvenation, and/or enjoyment of the experience itself. Seven percent of the sample fell into this category. Examples of how this category was expressed are:

“Um, and, and it’s also different, you know, adds variety to your life. It’s fun, I mean...that’s sort of what, well I guess how I’d describe it” (participant 0807C).

“Huh. Well, first of all, the fact that everything, all the Plexiglas was so clean, I really appreciate the fact that you can really see everything. Um, it was fun to go to the petting, uh invertebrate area. Um, frankly otters are a hoot, it was fun to look at the otter even though he was a little bit at a distance and everything, but he was doing a lot of grooming and everything. Um, and, I mean, how often do you get to go in a tunnel of fish, uh, in some ways I like the passages before the sharks better because the fish would just stand there and look at you and you’d look back at them, realize you were kind of on a one on one basis, whereas the sharks just keep passing by, you don’t really make a connection with them. Maybe that’s for the good” (Participant 0729B).

Percentages for these categories add up to more than 100% because visitors often gave two types of preferred experience types in their answers.

As defined by the Falk (2009) identity-related visitor motivation categories, responses given by participants in this study included 54% explorers who spoke of visiting the aquarium as

part of a larger trip and enjoying learning and exploration in general. Some examples of the ways in which research participants discussed this include:

“Uhhh, we were going on a five week vacation, and uh we started in Portland and I got some of the brochures, and uh the Wildlife Safari and ocean aquarium and those types of things is what interests me as something fun to do, so...we drove to Astoria and then down the coast to here. Came to stay in Newport to visit here” (Participant 0726B).

“Um, well we haven’t been here in a while...and figured since we were coming to the beach it’d be pretty cool to see the...animals and stuff” (Participant 0801B).

“Oh, we’ve heard positive things about it from people who have been here before and we’re in the neighborhood” (Participant 0807A).

Experience seekers are interested in the specific site they are visiting, and their visit to the area is often focused on visiting one particular place. Twenty-nine percent of the sample fell into this category. This category was expressed in the following ways:

“Well we’ve been here, this is our fourth trip to Newport from Missoula, and we love the aquarium, the kids love it and we like, we heard about the new Swampland, um, and uh wanted to see that” (Participant 0726E).

“I’ve heard a lot about it. I live far away, decided to plan a vacation around coming just to see it” (Participant 0729G).

Facilitators visit free-choice learning (FCL) environments with the express purpose of facilitating the education of others. In this study 11% of the sample fell into this category and all were interested in supporting their children’s learning:

“It’s been a few years since we’ve been here, probably at least three years, so we thought it’d be a good, good idea to get the kids out. And uh, um, see if, um, actually our daughter went this year, with her school, so we all decided, we, um uh um, our son is only a year and a half so we decided it would be a good time to get him out, get him started” (Participant 0801C).

“We haven’t been here for about twelve years, and now we have kids that, the last time we were here the youngest—the oldest was about two” (Participant 0804C).

The fourth category, the professional/hobbyist, visits in order to advance and/or practice their field or avocation within the institution. The visitor can be of any profession (scientist, photographer, painter), what matters is only that they are there for a reason related to their particular hobby or profession. Only one person in this study indicated this as their identity-related reason for visiting:

“Ummm, I’m actually taking a class this summer, it’s on ecosystems of the Pacific Northwest, and this was on the itinerary” (Participant 0726A).

The final visitor identity category is the recharger, people who visit for reasons akin to spirituality or inner peace. Eleven percent of the sample fell into this category and expressed it as following:

“We do it annually. It’s our annual, it’s in celebration of our, of my husband, who shall remain nameless, and I, when we first started dating. It’s supposed to be in June, but we didn’t get a chance to go” (Participant 0807F).

Percentages for these categories add up to more than 100% because visitors often responded to two types of visitor identity categories.

Science Identity

Science identity was determined by coding interview items that probed science-related activities, careers and hobbies, as well as comparing with appropriate items on an instrument typically used to measure science identity in science education studies (Aschbacher & Roth’s *Is science me?*, 2010). Twenty-one research participants (75% of the total sample) had sufficient data to code. Based on this coding, participants were categorized as having high, medium, or low science identity compared to other participants in the study. Participants grouped in the high science identity category were those who described professional or volunteer engagement within science, mathematics, engineering, and/or technology (STEM) fields. Twenty-eight percent of

study participants were included in this category. Participants who did not specifically discuss these types of experiences, but still discussed several types of science activities and/or a high frequency of science engagement during leisure time, were coded as having a moderate science identity within the scope of this study. Finally, visitors who discussed few or no science activities were coded as having a low science identity within the scope of this study. The medium and low science identity categories were represented by 36% of the study population each.

Participants most commonly listed outdoor/nature activities as the leisure science activity in which they engage most. Fifty-seven percent of participants within the study population were in this coding category. Hiking and nature walks were the most prominent type of outdoor activity described (50 %) within this category, with the remainder being such things as gardening, rock collecting, and bird watching. Some examples of answers in this category are:

“Oh, well we live on 50 acres of more or less wild land, um, between Ashland and Medford Oregon, so we have bears and deer and wild flowers so we spend a lot of time dealing with nature, both positive and negative sides of it, you know, put your trash out unless you want the bears to dine on it, that sort of thing. Yeah, I mean we really enjoy, I say we but, I mean, my wife and I, we both enjoy living around nature” (Participant 0729B)

“I do a little bit of bird watching, fishing if you would call that scientific, um, camp—well, this is more nature than scientific, uh, camping, hiking, little bit of backpacking. Outdoor activities” (Participant 0807A).

The second most common category of science activities were watching TV and/or reading science publications/books (even science fiction in one case), with 39 % of the sample population. Some examples of this type of response were:

“Heh, I read quite a few science magazines, astronomy magazines, uh watch a lot of nature programs at home” (Participant 0726D).

“Well, you know I did have sort of a scientific background, and I, I still love reading things like Scientific American. I like watching Discovery Channel, the science channel. I like science fiction of certain types, but not the beastly scary type, but the kind that makes you think and brings you further along” (Participant 0807C).

The third category of science activities in which research participants described engaging were primarily for the education or entertainment of family members, usually children. Fourteen percent of study participants gave this type of response. This was also the only category where participants expressed doing science activities in a less than positive way, in particular saying because of helping children their free-time science activity was less. Some examples of responses in this category were:

“Oh, chemistry experiments with my six year old daughter, um, well we home school, so all manner of different, um, field trips to outdoor places and, uh, bug collecting. We’re raising butterflies right now” (Participant 0801A).

“Um, the science activities that I would have done in my free time with my younger kids would have been for their educational benefit, so it’s not something I do as a hobby” (Participant 0804C).

There were some participants who described their free/leisure time activities as part of their professional or volunteer interests. Among these participants were scientists, educators, and volunteers. Twenty-five percent of study participants were in this category, interesting because the Falk Professional/Hobbyist category only included one person. Examples of this type of response were:

“I’m a science teacher, so everything” (Participant 0807B).

“I’m a horticulturalist, so I like plants, and I like to, um, to try plants in different areas of the yard and see where they grow, see, just experiment with them, see how, if I can make them grow better. Yeah” (Participant 0729F).

Answers coded as learning spaces were those that specifically listed an established type of learning institution to which they visit, such as a library or museum. Only two participants listed

this type of science activity as one they engage in during their free time and an example from this category is:

“Um, probably would be things like library, um, and uh, any kind of learning place...where...something that kids would go to learn” (Participant 0801C).

There were two participants who responded that they did not participate in any science activity during their free/leisure time, even when probed by the researcher. This is interesting since they were at the aquarium, generally considered to be a science learning space, and neither participant mentioned that they were visiting under duress. It is possible that they were more there for others or for relaxation and thus did not consider it as a typical science learning activity.

When answering this question, it was more common than not for participants' answers to fall into more than one of the coding categories established for this data. Two categories were the most common, but some responses had three types of answers. An example of multiple category answers is:

“Well we, uh, uh, live in Montana, so we like, um, we like to look for dinosaurs and dinosaur bones, and visit the Museum of the Rockies in Miss—in Bozeman. Then we also will look for, um, certain types of rocks in mines and mountains, uh, around the area” (Participant 0726E).

This response was coded into both outdoor/nature and learning spaces.

Visitor Experience and Gender Identity

High M Scores

The three highest and three lowest Z scores were separated out for each subscale and analyzed to determine associations between gender identity and the visitor experience. The eight characteristics that compose the high masculine side of the Masculine subscale are very independent, very active, very competitive, makes decisions easily, never gives up easily, very self-confident, feels very superior, and stands up well under pressure. Seven research participants scored high in this PAQ category and these seven were analyzed to determine associations between gender identity and the visitor experience.

Table 2. High Masculine Scores for Visitor Experience

Participant #	Preferred Experience Type	Why Favorite Exhibition	Favorite Part of Whole Visit	Standardized Score
0801F	object	introspective	object	1.6519
0804D	social	object	object	1.6519
0804A	object + social	social	object + social	1.0773
0726D	object + cognitive	object	object	0.7900
0726F	object	object	object	0.7900
0801B	object + cognitive	object + cognitive	object	0.7900
0807A	object + cognitive	object	object	0.7900

Responses to Preferred Experience Type, Why Favorite Exhibition and Favorite Part of Whole Visit were similar across coded categories within this subpopulation of research participants with high M scores. Participant 0726F provided object answers for all of the questions. Participant 0801B, who preferred object + cognitive experiences, gave either object or cognitive responses. Similarly, participant 0804A, who preferred object + social experiences, provided these types of responses. Only two in this subgroup had varying responses. Participant 0804D, a person

preferring social experiences expressed object experience responses for the Why Favorite Exhibit and Favorite Part of Whole Visit questions, and Participant 0801F provided two object answers (Preferred Experience Type and Favorite Part of Whole Visit) but was coded in the introspective category for the Why Favorite Exhibition question.

In terms of Identity-Related Visitor Motivation in this subgroup, six of the seven were coded as Explorers, with one person being an Experience Seeker (Participant 0726D). Five participants in this subpopulation listed Passages of the Deep as their favorite exhibition.

Low M Scores

The eight characteristics that are defined as being low on the masculine subscale are not at all independent, very passive, not at all competitive, difficulty making decisions, gives up very easily, not at all self-confident, feels very inferior, and goes to pieces under pressure. In this study four research participants scored as part of this subpopulation.

Table 3. Low Masculine Scores for Visitor Experience

Participant #	Preferred Experience Type	Why Favorite Exhibition	Favorite Part of Whole Visit	Standardized Score
0729F	object + cognitive	introspective + object	object	-1.5083
0804C	cognitive	introspective + object	object	-1.5083
0807E	object	object	object	-1.7956
0729A	cognitive	object	object	-2.0828

These participants were extremely inconsistent across their responses, with the exception of Participant 0807E who responded with an object-focused response to each item. For the others in this subgroup, object type experiences were given for the day's visit despite cognitive experience types given as their preferred experience.

There was similar variety in Visitor Identity among this subpopulation. Participants 0729F and 0807E were coded as Explorers, Participant 0804C was a Facilitator, and Participant 0729A was coded as a Recharger. There were no commonalities in which exhibition visitors reported as their favorite.

High F Scores

The High Feminine subscale is made up of the following eight characteristics: very emotional, able to devote self completely to others, very gentle, very helpful to others, very kind, very aware of feelings of others, very understanding of others, and very warm in relations with others. In this study only three participants scored in this subpopulation.

Table 4. High Feminine Scores for Visitor Identity

Participant #	Preferred Experience Type	Why Favorite	Whole Visit	Standardized Score
0729G	social	social	object	2.6687
0807D	object + cognitive	introspective + object	object	1.7462
0729D	cognitive + social	object	object	1.4387

There was some continuity of answers for each of these three participants across the Why Favorite Exhibition and Favorite Part of Whole Visit questions. Participant 0729D consistently gave object type answers for all three of the questions. Participant 0729G gave social experience responses for Why Favorite Exhibition, but responded with object experience for Favorite Part of Whole Visit. Finally, participant 0807D gave an object response for Favorite Part of Whole Visit and an object + introspective response for Why Favorite Exhibition. Two of the participants in this subpopulation were coded as Experience Seekers for their Visitor Identity category (0729G and 0807D), with participant 0729D coded as an Explorer. All three of these participants listed Passages of the Deep among their favorite exhibitions.

Low F Scores

The eight specific characteristics for this subscale are: not at all emotional, not at all able to devote self completely to others, very rough, not at all helpful to others, not at all kind, not at all aware of feelings of others, not at all understanding of others, and very cold in relations with others. Six participants were among the three lowest scores for this study population.

Table 5. Low Feminine Scores for Visitor Experience

Participant #	Preferred Experience Type	Why Favorite	Whole Visit	Standardized Score
0726E	cognitive + social	introspective + social	cognitive + social	-0.1424
0801B	cognitive + object	object + cognitive	object	-0.1424
0804C	cognitive	object + introspective	object	-0.1424
0726D	cognitive + object	object	object	-1.3289
0807F	cognitive + object	social	social	-1.3289
0729A	cognitive	object	object	-1.9439

Three of the participants in this subpopulation responded similarly to Why Favorite Exhibition and Favorite Part of Whole Visit when compared to their preferred Experience Type response. Participant 0726D responded with object experience type for both Why Favorite Exhibition and Favorite Part of Whole Visit. Participant 0801B responded to Why Favorite Exhibition with an object + cognitive response, and to Favorite Part of Whole Visit with an object response. Participant 0726E gave an introspective +social response for Why Favorite Exhibition and a social + cognitive response for Favorite Part of Whole Visit. Participant 0804C, who had expressed a cognitive Experience Type preference gave an object + introspective response for Why Favorite Exhibition, and an object response for Favorite Part of Whole Visit, and Participant 0729A, also a cognitive Experience Type gave object responses for Why Favorite Exhibition and Favorite Part of Whole Visit Finally, participant 0807F, a cognitive

+ social Experience Type, gave social responses to Why Favorite Exhibition and Favorite Part of Whole Visit.

In terms of their Visitor Identities, two research participants in this subgroup were coded as Experience Seekers (Participants 0726E and 0726D), two as Rechargers (Participants 0807F and 0729A), one as an Explorer (Participant 0801B) and one as a Facilitator (Participant 0804C). As with the Low M subpopulation, no consistent Favorite Exhibition emerged.

High M-F Scores

The masculine characteristics for the masculine-feminine (M-F) subscale are: very aggressive, very dominant, not at all excitable in a major crisis, very worldly, indifferent to others=approval, feelings not easily hurt, never cries, and very little need for security. Seven of the study participants had M-F scores high enough to be included in this subpopulation.

Table 6: High Masculine-Feminine Subpopulation

Participant #	Preferred Experience Type	Why Favorite	Whole Visit	Standardized Score
0807D	object + cognitive	introspective + object	object	2.8759
0726B	object	object	outlier	1.2707
0726D	object + cognitive	object	object	1.0032
0726F	object	object	object	1.0032
0729A	cognitive	object	object	1.0032
0801B	object + cognitive	object + cognitive	object	1.0032
0804D	social	object	object	1.0032

Three participants (0726B, 0726F and 0801B) were consistent in their responses across the questions Why Favorite Exhibition and Favorite Part of Whole Visit when compared to their preferred Experience Type. Two participants showed some consistency across response types for these questions. Participant 0807D's (an object + cognitive preferred type) responses were

coded as introspective + object for Why Favorite Exhibition and as object for Favorite Part of Whole Visit. Participant 0726D (an object preferred type) gave object type responses for Why Favorite Exhibition and Favorite Part of Whole Visit. Finally, two of the participants (0729A and 0804D) in this subpopulation had no continuity between their preferred Experience Type (0729A-cognitive and 0804D- social) and the other questions. Both reported object type experiences for Why Favorite Exhibition and Favorite Part of Whole Visit.

In terms of Visitor Identity four were Explorers (0726B, 0726F, 0801B and 0804D), two were Experience Seekers (0807D and 0726D) and one was a Recharger (0729A). No consistent Favorite Exhibition emerged within this subpopulation.

Low M-F Scores

The feminine characteristics of the M-F subscale are as follows: not at all aggressive, very submissive, very excitable in a major crisis, highly needful of others' approval, feelings easily hurt, cries very easily, and very strong need for security. There were four participants in this subpopulation.

Table 7: Low Masculine-Feminine Subpopulation

Participant #	Preferred Experience Type	Why Favorite	Favorite Part of Whole Visit	Standardized Score
0804B	object	object	object + social	-1.1370
0801C	social + cognitive	social	cognitive	-1.1370
0729B	introspective + object	introspective + object	cognitive	-1.4045
0729F	object + cognitive	introspective + object	object	-1.9396

Participants 0801C and 0729F had the highest degree of continuity across their answers, with participant 0804B slightly less so because of the social response to Favorite Part of the Whole

Visit. Participant 0729B's response deviated the most within this subpopulation by giving a cognitive exhibition type answer for Favorite Part of the Whole Visit.

In terms of Visitor Identity, participants 0804B, 0729B and 0729F all were classified as Explorers, and participant 0801C was classified as a Facilitator. Three of these participants listed the Sea Otters and Passages of the Deep among their favorite exhibitions.

Science Identity and Gender Identity

Tables 8-13 show the breakdown of science identity within the three subsets of gender, and for each subpopulation within the subsets, as done above with visitor experience. There were no trends noted between a participant's gender identity and their reported free time science activities or with their science identity for any of the subpopulations within these data.

High M Scores

Table 8. High Masculine Scores for Science Identity and Visitor Experience

Participant #	Annual Visitation	Free Time Science Activities	Science Identity	Preferred Experience Type	Standardized M Score
0801F	twice	Outdoor/nature	Low	object	1.6519
0804D	once/month	Outdoor/nature	Medium	social	1.6519
0804A	once (at most)	TV/books + Family	Medium	social + object	1.0773
0726D	twice	TV/books	Medium	cognitive + object	0.79
0726F	one to two	TV/books + outdoor/nature	Medium	Object	0.79

0801B	volunteer at Oregon Zoo 5x/week; once with family	Professional/volunteer + TV/books + outdoor/nature	High	cognitive + object	0.79
0807A	once	Outdoor/nature	Medium	cognitive + object	0.79

Low M Scores

Table 9. Low Masculine Scores for Science Identity

Participant #	Annual Visitation	Free Time Science Activities	Science Identity	Experience Type	Standardized M Score
0729F	three	Professional/volunteer	High	object + cognitive	-1.5083
0804C	twice	Family	Low	cognitive	-1.5083
0807E	twice	Outdoor/nature	Low	object	-1.7956
0729A	once	none really	Low	cognitive	-2.0828

High F Scores

Table 10. High Feminine Scores for Science Identity

Participant #	Annual Visitation	Free Time Science Activities	Science Identity	Experience Type	Standardized F Score
0729G	once	TV/books	Low	social	2.6687
0807D	four	Outdoor/nature + professional/volunteer	High	object + cognitive	1.7462
0729D	usually never	Professional/volunteer + TV/books	High	Object	1.4387

Low F Scores

Table 11. Low Feminine Scores for Science Identity

Participant #	Annual Visitation	Free Time Science Activities	Science Identity	Experience Type	Standardized F Score
0726E	twice	Outdoor/nature + learning spaces	Medium	cognitive + social	-0.1424
0801B	volunteer at Oregon Zoo 5x/week; once with family	Professional/volunteer + TV/books + outdoor/nature	High	cognitive + object	-0.1424
0804C	twice	Family	Low	cognitive	-0.1424
0726D	twice	TV/books	Medium	cognitive + object	-1.3289
0807F	twice	Family	Low	object + cognitive	-1.3289
0729A	once	none really	Low	cognitive	-1.9439

High M-F Scores

Table 12. High Masculine-Feminine Scores for Science Identity

Participant #	Annual Visitation	Free Time Science Activities	Science Identity	Experience Type	Standardized M-F Score
0807D	four	Outdoor/nature + professional/volunteer	High	object + cognitive	2.8759
0726B	twice	Outdoor/nature + TV/books	Medium	Object	1.2708
0726D	twice	TV/books	Medium	cognitive + object	1.0032
0726F	one to two	TV/books + outdoor/nature	Medium	Object	1.0032
0729A	once	none really	Low	cognitive	1.0032
0801B	volunteer at Oregon Zoo 5x/week; once with family	Professional/volunteer + TV/books + outdoor/nature	High	cognitive + object	1.0032
0804D	once/month	Outdoor/nature	Medium	social	1.0032

Low M-F Scores

Table 13. Low Masculine-Feminine Scores for Science Identity

Participant #	Annual Visitation	Free Time Science Activities	Science Identity	Experience Type	Standardized M-F Score
0801C	every other year	Learning spaces	Medium	social + cognitive	-1.137
0804B	four	TV/books + outdoor/nature	Medium	object	-1.137
0729B	once	Professional/volunteer + outdoor/nature	High	introspective + object	-1.4045
0729F	three	Professional/volunteer	High	object + cognitive	-1.939

Chapter 5: Discussion

As a hypothesis-generating study, this thesis was not designed with the intent of providing conclusive evidence of a link between a visitor's gender identity and his/her preferred type of experience or his/her science identity. Accordingly, any interesting trends arising from these data are discussed as "hints" by the researcher, rather than strong correlations, links or associations. These hints will be used to suggest directions for future research and practice.

Connections between gender identity and visitor experience

Masculine Subpopulation

High Masculine Pekarik, Doering and Karns (1999) found that men were more likely to describe object experiences when asked about visit experiences and preferences. In this study six of the seven participants in the High Masculine (M) subpopulation described object experiences when asked why they liked visiting the aquarium. While it is inappropriate to generalize from only seven individuals, this finding does highlight interesting hints about the link between gender identity and visitor experience. There was also enough consistency among described experience types throughout interviews within this group to suggest a link between gender identity and visitor experience. Individuals in this subpopulation self-evaluate themselves as more independent, more self-confident, and able to make decisions more easily. This may mean that they are more likely to have selected the aquarium for the specific exhibition experiences it affords. In addition, because they know what they like during an experience they may be more direct and able to describe the experience and their preference for it, which is hinted at in the data presented here.

The number of research participants who scored in the High M subpopulation was the highest of any of the subpopulations, along with those participants scoring in the High Masculine-Feminine (M-F) subpopulation. While this may be an accurate representation of aquarium visitors, it is also possible that this subpopulation is inflated because of the characteristics of individuals in this subgroup. Individuals in this subgroup are more independent, more competitive, more self-confident, and feel more superior to individuals with less masculine gender identities, and these qualities may make these individuals more likely to be willing to participate in a study. Further research that more broadly explores the gender identities of aquarium visitors needs to be conducted in order to confirm or disconfirm the hinted trends discussed here.

Six of the seven participants in this subpopulation had a visitor identity of explorer on this particular day, with the one outlier identifying as an experience seeker. While no characteristic of this subpopulation seems to entirely account for this proclivity towards exploring, they are individuals who are curiosity-driven and expect to find something in a FCL setting that will grab their attention and fuel their learning. It may be that individuals who are active and self-confident are more willing to allow events to unfold, rather than go after a specific type of experience. Further investigation into visitor identity through the gender identity lens could help to illuminate the exploratory nature of highly masculine visitors.

Low Masculine In contrast to the High M subpopulation, the Low M subpopulation only included four of the research participants. While it is possible that this reflects the composition of typical aquarium visitors participating in the study, as with the High M subpopulation, it is also possible that the size of this subpopulation is a function of the characteristics that set it apart from the other gender identity subpopulations. An individual who is not self-confident or

competitive, and passive may not volunteer to participate in a study. A gender identity distribution study of typical visitors to aquariums would help to unravel this issue for future research, and potentially for practice.

When asked about what type of visit experience they preferred, participants in this subpopulation reported either cognitive and/or object experiences. However, when asked further questions about their experience during their visit, answers were highly object-related with some introspection responses. Also, no one in this subpopulation gave any social experience answers, even though one participant reported their visitor identity as a Facilitator. These inconsistencies may stem from the fact that these visitors were not sure of the kind of experience they wanted to have at the aquarium since individuals with this gender identity have difficulty making decisions. It is not out of the range of possibility, though, that individuals who are passive and not self-confident will give answers that they think the researcher is looking for or wants to hear. There is little that can be done to illuminate this behavior in a self-report study, but it is something to keep under consideration when forming hypotheses for further study.

When asked about their visitor identity, this subpopulation yielded two explorers, one facilitator, and one recharger. While the presence of explorers and a recharger is mirrored in the cognitive, object and introspective experiences of participants in this subpopulation, the presence of a facilitator in the absence of any social experience, preferred or otherwise, is an anomaly that bears further investigation. It could be the fact that these individuals have more difficulty making decisions or are less confident as the higher masculine subpopulation, both factors which could lead individuals to give an answer that they think the researcher wants to hear rather than a more personally candid answer. This suggests that more inquiry into the subtle interactions between researcher and participant along gender identity lines is warranted.

Feminine Subpopulation

High Feminine The low number of participants within the High Feminine (F) subpopulation makes it impossible to discuss this finding with any certainty, however, the fact that this subpopulation was so infrequent raises some interesting questions. In particular, is this an accurate representation of the profile of gender identities across aquarium visitors, or is there another reason for the low representation in this particular study? Recruitment was on a volunteer basis within each group approached. Five of the eight characteristics in the High F subpopulation focus on how these individuals interact with other people. While one interpretation of “very helpful to others” might suggest a greater tendency to volunteer to participate in a study, it may also mean that these persons were more likely to let others who were more eager within the group to volunteer, or did not want to volunteer and disrupt a group outing, since members of this subpopulation are also more “aware of feelings of others” and “very understanding of others.” This issue would need to be taken into consideration when planning any future research into visitor gender identity. The same limitation of a small sample size for this subpopulation makes any speculation into visitor identity difficult and potentially misleading.

Low Feminine Several interesting hints can be teased out of the Low F score subpopulation. All of these participants described cognitive experiences as their preferred experience type, even if it was coupled with another type of preferred experience (e.g. object or social). Within the coding scheme used, Pekarik, Doering and Karns (1999) describe cognitive experiences as those focused around personal learning, rather than the facilitation of the learning

of others (which they describe as social experiences). The majority of Visitor Identities for this subpopulation were also personally oriented with only one person describing the facilitation of others' experiences as the reason they visited the aquarium on this day. When viewed through the lens of gender identity though, it is interesting to note that individuals in this subpopulation rate themselves as less helpful to others, less aware of the feelings of others, less understanding of others, and cooler in relationships to others. As the interviews progressed, these participants continued to discuss more personally-oriented experiences. There were a few references to social experiences, but only in the reported experience, and only by two of the participants in this subpopulation. This suggests that perhaps while social experiences were not a driving force for these visitors, they do acknowledge the learning and enjoyment of those around them as an important part of the overall experience. These hints are further evidence that further research into this area is warranted, especially in the area of how group dynamics interact with gender identity characteristics.

Visitor identity among this subpopulation included two experience seekers, two rechargers, a facilitator, and an explorer. The one facilitator did not describe any part of their experience as social. Without a larger sample size, it is impossible to know if this is an anomalous visitor identity or if this is simply a part of a much more complex picture than can be painted here. The presence of rechargers is in line with the supposition that visitors in this subpopulation are more aware of, and willing to admit to their own needs and desires when it comes to visiting an institution such as the aquarium. Again, without further research these hints are nothing more than speculation.

Masculine-Feminine Subscale

This subscale differs from the Masculine and Feminine subscales in a very important way. The previous two subscales measure an individual's level of androgyny, so for each scale the dipoles are either Very Masculine (or Feminine) or Not Masculine (or Feminine). For these, Not Masculine does not mean Feminine, and Not Feminine does not mean Masculine. An individual can be both Very Masculine and Very Feminine or Not Masculine and Not Feminine at the same time. However, when using the Masculine-Feminine (M-F) subscale, Very Masculine does mean Not Feminine, and vice versa. Also, while the paired characteristics of the Masculine and Feminine subscales are neither desirable, nor undesirable (just more common among one group than the other), the paired characteristics of the M-F subscale are desirable/undesirable. Characteristics on the M side of the scale are desirable in men and undesirable in women, while the characteristics on the F side are undesirable in men and desirable in women.

High Masculine-Feminine: The frequency of research participants in the High M-F subpopulation was the same as in the H Masculine (M) subpopulation. As suggested, this may be an artifact arising from the type of individuals who were willing to participate in this study. People who are very dominant and do not require the approval of others (compared to the sample population) may have been more likely to volunteer to participate in the study. As before, this suggests that a gender identity study of a larger number of aquarium visitors should be conducted. Similar to the high M subscale visitor experiences, both those preferred and the ones visitors in this subgroup actually experienced, were highly object-oriented. The only participants with less consistency between their preferred and actual experiences were those who described

some other aspect than object for their preferred experience type. Unlike the other subpopulations though, none of the gender characteristics in this subpopulation seem to explain the changes between their preferred experience type and the one they actually had.

With four explorers, two experience seekers, and one recharger, this subpopulation has no more consistency within their visitor identities than the others discussed so far, with the exception of the high masculine subpopulation. As with the low masculine and high feminine subpopulations with very small sample sizes, there is not enough evidence in this study to determine whether this group has no preferred visitor identity, or if a larger sample size would reveal a preference.

Low Masculine-Feminine: The Low M-F subpopulation consisted of four participants, the same number of participants who were in the Low M subpopulation. All four experience types were represented in this subpopulation, in both their preferred experience type and the one they actually experienced. Despite its small size, this subpopulation also had the highest incidence of introspective experiences. This may reflect the characteristics of this subpopulation which include strong emotional components. Another explanation for the introspective responses given by members of this subpopulation is that they are seeking security within the aquarium by remembering past experiences, or by relaxing and rejuvenating. Further research is needed to see if these possible explanations are correct or not, and also if this is specific to the setting of an aquarium or would be the same in different types of FCL science institutions such as science centers or museums.

It is worth noting that this subgroup, which scored with characteristics the least like the high masculine group based upon the Personal Attributes Questionnaire (PAQ) had only four

participants and seemed to favor the explorer visitor identity. A possible difference here could relate to the choice of the explorer identity. “Explorer” can be categorized as the most non-committal of the visitor identities to a particular setting; they often have a generic interest in the content of the FCL setting, expecting to find something that will grab their attention and fuel their learning wherever they are. Possibly this represents a good choice for an individual who identified as submissive and needful of other’s approval (potentially both of the researcher and/or members of his/her own group).

Overall Gender Identity

Three of the study participants are represented in all three subpopulations described above. Participants 0726D and 0801B are represented in the High M, Low F, and High M-F subpopulations. Participant 0729A is in each of the Low M, Low F, and High M-F subpopulations. These participants help to demonstrate the complexity of an individual’s gender identity. Whereas participants 0726D and 0801B could be described generally as masculine based on their PAQ scores, it is much more difficult to make a generalization about participant 0729A. This also points out the importance of viewing gender in more nuanced ways since if these complexities are difficult to assess when using the psychosocial gender terms of “masculine” and “feminine” present in the PAQ, the complexities lost by simply labeling individuals as “male” or “female” become more clear.

Connection between science identity and gender identity

The results from this study were inconclusive when it came to any link between science identity and gender identity. It could be that the sample size for each subpopulation is not large enough for any significant finding to emerge, but is more likely that discovering an individual’s

science identity, even in the broadest terms, requires more specific and guided inquiry than was performed here. This could possibly be achieved by developing a tool similar to the Personal Attributes Questionnaire (PAQ) for assessing science identity.

Connection between science identity and the visitor experience

Although the measurement of science identity was somewhat problematic due to limited data available for each participant and the Is science me? instrument having been designed for middle school-aged children in a formal education setting, some links between a visitor's preferred experience and their science identity/free time science activities can be noted (referring to tables 8-13). There is a potential link between those who engage in outdoor/nature activities and a preference for object experiences. Participants who engage in science activities that involve TV/books and family tended to prefer a cognitive experience, and there is some indication that cognitive experiences are also preferred by participants who engage in professional/volunteer science activities. Introspective experience types were also linked with participants who are professionals/volunteers. Though the data in these tables represents only 75% of the total study population, it is evident that there are potential deeper connections emerging.

Chapter 6: Conclusion

Although I stress the tentative nature of some of the specific findings in this study, there are a few points that I can make regarding the usefulness of the two constructs investigated in this thesis work. Probably the most important point is that it does seem that gender identity is a useful construct that could broaden the free-choice learning (FCL) field's ability to understand the complexity of the visitor experience and explain some of the equivocal findings about traditional influences of sex in interactions in such settings. It suggests that there are nuances within a person's identity that cannot be captured by traditional demographic measures. This study suggests that gender identity may be a useful construct to use in situations in which traditional male/female distinctions yield no or unanticipated results. Utilizing gender identity as an independent variable may offer a more effective way to gain deeper understanding of who is using the exhibition (or technology, or other tool), but also highlight what it is about the exhibition specifically and overall experience in general that is appealing to visitors. .

Although science identity did not emerge as an important variable, as I pointed out there are likely conceptual and measurement issues affecting that finding. Most of the measures of science identity have been developed for formal settings and there is a need for a FCL-appropriate version since it seems that science identity should influence the type of experiences preferred by visitors and that there might be interesting connections between gender identity and science identity. Current tools are geared more towards children, but the life-long learning potential of FCL institutions requires either multiple tools for children, adolescents, and adults, or a tool that is age independent. The equivocal links between visitor experience, both preferred and actual, and science identity could also be more fully explored with a science-identity tool.

This information could then be used by FCL institutions to tailor programs and exhibition content in such a way as to maximize experiences for visitors.

Implications for Practice

Gender biases and stereotypes can be conveyed in multiple ways, both consciously and subconsciously, as well as intended and unintended. It is important that we, as science educators and members of society, pay particular attention to what messages science activities send to women about the kind of person they need to become to succeed in science, and how these messages can help or hinder their participation. It is also important to consider the gender identities that women and girls already have, and how these might affect their participation in science activities, both in school and in free-choice settings like museums and aquariums.

Despite the preliminary nature of this study, some of the findings, and certainly the approach, has potential practical applications for the aquarium. A more extensive visitor study effort to determine the gender identity of visitors to the Aquarium would be an excellent first step to test the findings of this preliminary study. Collecting data across seasons and days of the week would enhance this data set greatly. They might also consider altering demographic questions on exit surveys to better represent the nuanced levels of gender in order to understand more fully who their visitors are and how they experienced the aquarium. These items would probably not be as specific as those used in this study, but any effort to expand beyond the typical “M” and “F” labels would help.

The popularity of certain exhibitions (namely Passages of the Deep) by some subgroups in this study might also be of interest to the aquarium. This study did not have the scope to investigate what properties of Passages of the Deep were so appealing to particular subgroups,

and what changes could be made to make it more appealing to other subgroups, and whether, and if so how, this appeal might be transferred to other exhibitions in the aquarium.

The aquarium also relies on a large staff of volunteers, and this new information on gender identity may be useful for volunteers to know about to help diminish any potential preconceptions they might have about visitors based on biological sex. These are only the first of many ways that the aquarium, and other institutions in the future, might use the findings, however preliminary, from this research.

Limitations

The primary limitation of this study arises from the narrowness of the study location. Only one aquarium was used as a study site, and it is possible that different aquariums, with different types of displays and varying content, may have yielded different results than are reported here. This limits the study's external validity and generalizability.

Another limiting factor for external validity is the small sample size. While this sample size was agreed upon as sufficient for the hypothesis-generating nature of this research, a larger sample size would have provided additional information. Both of these limitations were taken into consideration prior to data collection.

There is one other potential limitation to this study. The validity and reliability of the Pekarik, Doering and Karns' categories have been questioned in the field, particularly in terms of difficulties discerning differences between Object Experience preferences and Cognitive Experience preferences. It is possible that there is some confounding between these two categories that affected the results of this study.

Future Research

There are several possibilities for future research based on the findings from this exploratory, hypothesis-generating study. One possibility would be to expand the current study to include more participants at additional institutions in order to validate the preliminary patterns observed at the Oregon Coast Aquarium and to compare gender identity profiles. For instance it would be interesting to determine whether results are different based on the type of science presented, such as aerospace science at the Evergreen Aviation & Space Museum versus biology-based science at the Oregon Coast Aquarium.

Another option would be to have more than one person per group participate in the study. This would add the element of group experience and tease apart the different roles each individual potentially plays within their group. Both of these options would be appropriate for studying either gender or science identity, but further research into evaluating an individual's science identity needs to be explored, before either of these future studies could be conducted. .

There is also further analyses that can be conducted with the data collected from this study. For instance, the data collected about how each group made their way through the aquarium could yield questions of further interest and perhaps help to explain some of the visitor experience preferences, as could the data collected about the visitor's overall impression of the aquarium. This study was specifically designed to generate ideas for further study, and the partial list of possibilities presented here, demonstrate that this goal was achieved.

Significance

Given these findings, it is important to discover the underlying causes for the continually low, and in some cases decreasing, numbers of women in STEM fields. Most of the research in

this area has been conducted in formal contexts so this study has the potential to expand understanding about how individuals who are not supported in these contexts (i.e. women and/or feminine-identified persons) interact with science and how these experiences shape and reinforce their personal science identities. This study demonstrates that understanding a person's identity in a more nuanced manner, rather than just their biological makeup, can lead to deeper, more meaningful understanding of how an individual's gender identity influences their participation in STEM areas in a free-choice learning setting. This approach could also be applied to more formal learning settings.

By transcending the notion of male and female as merely biological, and looking at both the participants in STEM fields and STEM learning activities, as well as the fields themselves through the psychosocial lens of gender identity, it may be possible to come to a deeper understanding of why there is still a gender gap in many STEM fields. A deeper understanding of why this is the case could then be used to reshape the field's approaches, both in school settings and FCL settings, leading towards true equality.

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Appendix A: Personal Attributes Questionnaire

Instructions:

The items below inquire about what kind of person you think you are. Each item consists of a PAIR of characteristics, with the letters A-E in between. For example,

Not at all artistic A.....B.....C.....D.....E Very artistic

Each pair describes contradictory characteristics - that is, you cannot be both at the same time, such as very artistic and not at all artistic.

The letters form a scale between the two extremes. You are to choose a letter which describes where YOU fall on the scale. For example, if you think that you have no artistic ability, you would choose A. If you think that you are pretty good, you might choose D. If you are only medium, you might choose C, and so forth.

M-F	1.	Not at all aggressive	A.....B.....C.....D.....E	Very aggressive
M	2.	Not at all independent	A.....B.....C.....D.....E	Very independent
F	3.	Not at all emotional	A.....B.....C.....D.....E	Very emotional
M-F	4.	Very submissive	A.....B.....C.....D.....E	Very dominant
M-F	5.	Not at all excitable in a major crisis	A.....B.....C.....D.....E	Very excitable in a major crisis
M	6.	Very passive	A.....B.....C.....D.....E	Very active
F	7.	Not at all able to devote self completely to others	A.....B.....C.....D.....E	Able to devote self completely to others
F	8.	Very rough	A.....B.....C.....D.....E	Very gentle
F	9.	Not at all helpful to others	A.....B.....C.....D.....E	Very helpful to others
M	10.	Not at all competitive	A.....B.....C.....D.....E	Very competitive
M-F	11.	Very home oriented	A.....B.....C.....D.....E	Very worldly
F	12.	Not at all kind	A.....B.....C.....D.....E	Very kind
M-F	13.	Indifferent to others= approval	A.....B.....C.....D.....E	Highly needful of others' approval
M-F	14.	Feelings not easily hurt	A.....B.....C.....D.....E	Feelings easily hurt
F	15.	Not at all aware of feelings of others	A.....B.....C.....D.....E	Very aware of feelings of others
M	16.	Can make decisions easily	A.....B.....C.....D.....E	Has difficulty making decisions
M	17.	Gives up very easily	A.....B.....C.....D.....E	Never gives up easily
M-F	18.	Never cries	A.....B.....C.....D.....E	Cries very easily
M	19.	Not at all self-confident	A.....B.....C.....D.....E	Very self-confident
M	20.	Feels very inferior	A.....B.....C.....D.....E	Feels very superior
F	21.	Not at all understanding of others	A.....B.....C.....D.....E	Very understanding of others

- | | | | | |
|-----|-----|------------------------------------|---------------------------|------------------------------------|
| F | 22. | Very cold in relations with others | A.....B.....C.....D.....E | Very warm in relations with others |
| M-F | 23. | Very little need for security | A.....B.....C.....D.....E | Very strong need for security |
| M | 24. | Goes to pieces under pressure | A.....B.....C.....D.....E | Stands up well under pressure |

Appendix B: Interview Questions

Science Identity Questions

- How often do you visit aquariums and/or museums?
- What are some of the things you like about visiting aquariums/museums?
- What other kinds of science activities do you like to do? (i.e. watching science videos, taking nature walks, reading science books)

Visitor Experience Questions

- Why did you decide to come to the aquarium today?
- Who did you come with today?
- Can you describe the path you took through the aquarium today? (a map of the aquarium will be available to help visitors describe the course they took during their visit)
- Which exhibits were you particularly drawn to today? Why?
- What was your favorite part about today's visit to the aquarium?
- What are your overall impressions of this particular aquarium?
- Is there anything else you'd like to add?

Appendix C: Informed Consent Form

INFORMED CONSENT FORM

Project Title: Gender Identity and the Visitor Experience: Looking Closely at Aquarium Visitors
Principal Investigator: Dr. Lynn D. Dierking (541-737-1823)
Student Researcher: Laia Robichaux (512-963-1983, robichal@onid.orst.edu)
Co-Investigator(s): Dr. Larry G. Enochs (541-737-1305, enochsl@onid.orst.edu)
Version Date: July 1, 2010

The purpose of this study is to look into the potential influence of gender identity on visitor experience at the Oregon Coast Aquarium. This is being done for a master's thesis at Oregon State University (OSU). Up to 30 individuals will be included in this study. Participants must be 18 years of age or older. If you choose to participate, you will be asked to fill out a questionnaire and engage in an interview. The survey will take about 10 minutes to fill out, and the interview will take no more than 30 minutes. Interviews will be audio recorded for accuracy later in the study process. Participation is voluntary and may be terminated at any time without penalty. You will not receive compensation for your participation in this study. There are no foreseeable risks or benefits for participants. Any questions about the study may be directed to any of the people listed on this form. In the event you have questions about your rights as a participant, contact the OSU Institutional Review Board at irb@oregonstate.edu or by telephone at 541-737-8008. Thank you for your time and cooperation.

Appendix D: Sex Demographics of Study Participants

Participant #	Participant's Sex (as determined visually by the researcher)
0726A	Female
0726B	Male
0726D	Male
0726E	Male
0726F	Male
0729A	Male
0729B	Male
0729D	Male
0729F	Female
0729G	Female
0729H	Female
0801A	Female
0801B	Female
0801C	Male
0801E	Female
0801F	Male
0804A	Male
0804B	Female
0804C	Female
0804D	Female
0804E	Male
0804F	Female
0807A	Male
0807B	Female
0807C	Male
0807D	Female
0807E	Female
0807F	Female