ESSENTIAL CURRICULUM COMPONENTS FOR PREPARING AQUATIC ANIMAL HEALTH VETERINARIANS

By

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To all the people sacrificing pay to make the world a better place
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<td>AAVMC</td>
<td>Association of American Veterinary Medical Colleges</td>
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<td>ACZM</td>
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<td>AERA</td>
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<td>COE</td>
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<td>DVM</td>
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<td>FAQ</td>
<td>Frequently Asked Questions</td>
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<td>IAAAM</td>
<td>International Association for Aquatic Animal Medicine</td>
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<td>ISAAH</td>
<td>International Symposium on Aquatic Animal Health</td>
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<td>KSAs</td>
<td>Knowledge, Skills, and Abilities</td>
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<td>NACE</td>
<td>National Association of Colleges and Employers</td>
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<td>NAVLE</td>
<td>North American Veterinary Licensing Examination</td>
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<td>NAVMEC</td>
<td>North American Veterinary Medical Education Consortium</td>
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<td>NCME</td>
<td>National Council on Measurement in Education</td>
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<td>RG</td>
<td>Recent veterinarian Graduate</td>
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Outcome assessment data is an important component of the formal education process. Given the multiple stakeholders involved, both recent graduates from veterinary school in aquatic animal health (AAH) careers and their employers were asked about need-at-entry technical and non-technical skills. First, a 43-item novel survey instrument was developed and sent to 93 employers. Respondents (72%) have been working in the AAH field for a mean of 19.5 years. The participating employers were then asked to help recruit recent graduate participants to complete a 36-item survey instrument (similar to the one they took). At least 29 recent graduates received the survey and 86% of them responded. Respondents in both groups represented government, universities, small business (including private practice and independent contractors), corporations and non-profits (including zoos and aquariums). Lastly, six interviews were conducted with recent graduates for further explanation of career readiness needs and barriers. This mixed methods study design allows for a deeper understanding of the highly diverse system.

Primary findings for technical preparation included an overall employer feeling of recent graduates’ knowledge and experience being below needs for work with all
aquatic taxa but especially fish, which were the most frequent taxa encountered by specialists (42% of time). This deficit perception was not acknowledged by the majority of recent graduates. For non-technical skills, Teamwork/Interpersonal skills closely followed by Communication, and then Time management needed the most improvement amongst veterinarian employees and colleagues, according to employers. Yet, recent graduates mostly felt that they met or exceeded the need for all non-technical skills except Business savvy. Interviewees felt active learning experiences best prepared them for their career and viewed mentor relationships as crucial to their success.

Enhanced training in non-technical areas should benefit all students, not just AAH specialists, as the literature shows these skills are common needs of veterinary professionals. Likewise, changes in teaching style to foster student-centered learning should improve outcomes for all students and reflects the competency-based direction the profession is already shifting towards. Beyond educator recommendations, students must also pursue educational opportunities through electives and continuing education to form realistic career expectations and gain ever-evolving required skills.
CHAPTER 1
INTRODUCTION

Background

“The primary objective of veterinary medical education is to graduate veterinarians with the skills that are highly valued by employers and by society in general” (North American Veterinary Medical Education Consortium [NAVMEC], 2011, p. 31). This chapter describes the educational process of veterinarians in the United States, job market trends, and the shift in veterinary medical education from broad, factual-knowledge curricula focus to more competencies-driven curricula. The main elements of this drive for competency-based curricula are to increase educational focus on comparative medicine disciplines (including improvement in the training for veterinarians outside of private practice), provide enhanced training in One Health (the amalgam of animal, human, and environmental health) to meet society’s increased needs, and produce graduates with the professional competency skills that are needed beyond technical knowledge and skills (NAVMEC, 2011). Aquatic Animal Health (AAH) is a specialty within veterinary medicine and is used herein as the basis for evaluation of essential elements within veterinary medical curricula for preparing veterinarians for a specialty.

Aquatic Animal Health

AAH is a broad field that includes areas such as aquaculture (pet fish production, as well as food fish, invertebrates, etc.), stranded animal response (providing care to marine animals in distress), and aquarium medicine. Most veterinary medicine evaluations of preparedness (also known as career readiness) and job market prediction studies focused on equine and small animal medicine veterinarians (Brown &
Silverman, 1999; Danielson, Wu, Fales-Williams, Kirk, & Preast, 2012; Farnsworth et al., 2008; Lewis & Klauser, 2003; Walsh, Osburn, & Christopher, 2001). Smaller subsets of veterinary specialists, such as pathologists and aquatic animal health doctors, have not been investigated or were lumped together in an “other” category. The other categories were sometimes broken down further, depending on the study aims, but even those that had a unique category for zoological medicine did not typically differentiate between those working in exotic companion animal practices (seeing rabbits, snakes, fish, etc.), zoo and aquarium medicine, wildlife rehabilitation facilities, government agencies (policy or research positions with National Marine Fisheries Service, Food and Drug Administration, Department of Defense, etc.), universities (education and research tracks) and business (aquaculture, pharmaceuticals, nutrition, etc.). Thus, aquatic animal health already includes a variety of species and a diverse population of clinical practitioners, researchers, educators, policy makers, and businesspeople, but the field is often also grouped into a category with those working with a breadth of terrestrial species.

**Veterinary Medical Education**

The American Veterinary Medical Association (AVMA) Council on Education (COE) is recognized as the accrediting body for veterinary medical education in the United States and Canada by the U.S. Department of Education and the Council for Higher Education Accreditation (“COE Accreditation Overview,” 2014). The eleven standards for accreditation renewal includes a curriculum and an outcome review, among other things (“COE Accreditation Requirements,” 2014). In particular, the COE notes “Student achievement during the pre-clinical and clinical curriculum and after graduation [emphasis added] must be included in outcome assessment” (“COE
Accreditation Requirements,” 2014). Furthermore, the curricula standard includes the statement:

There must be sufficient flexibility in curriculum planning and management to facilitate timely revisions in response to emerging issues, and advancements in knowledge and technology. …opportunities throughout the curriculum [should exist] for students to gain an understanding of professional ethics, influences of different cultures on the delivery of veterinary medical services, delivery of professional services to the public, personal and business finance and management skills; and gain an understanding of the breadth of veterinary medicine, career opportunities and other information about the profession (“COE Accreditation Requirements,” 2014).

Thus, a curriculum should provide non-technical training and general career preparation, such as soft skill training, in addition to the traditionally expected technical training. Furthermore, curriculum updates are expected for continued accreditation.

Accredited veterinary medicine curricula are four-year programs culminating in the Doctor of Veterinary Medicine (DVM) degree. This professional degree program is typically pursued after matriculation with a Bachelor of Science degree but minimally after approximately 36 credits of undergraduate education in science and mathematics (“Steps to becoming a veterinarian,” n.d.). Veterinary medicine curricula often starts with a broad general medical education emphasizing canines, equids, and food animals for several years, and then students enter the clinical track portion divided between small animal and large animal medicine (“Curriculum Design,” n.d.; Farnsworth & Fiechtner, 2007; Turnwald, Sponenberg, & Meldrum, 2008b). Students will pick an emphasis track but must pass rotations in both (Farnsworth & Fiechtner, 2007; Maki, 2013; Turnwald et al., 2008b). Additionally, elective courses can be taken to gain experience in other specialties, such as aquatic animal health, and some universities offer alternative tracks such as Mixed, Alternative, or separating out Food Animal as its own track
Electives could be didactic courses or clerkship rotations (multi-week, supervised clinical practice experiences), which could be within a department at the college's veterinary hospital or off-site, then termed an externship, (“Curriculum,” n.d.; “Curriculum Design,” n.d.; Farnsworth & Fiechtner, 2007; Turnwald et al., 2008b). None of the colleges offer an AAH-specific track but the University of Florida does offer a 15-credit Certificate in Aquatic Animal Medicine which can be earned at the same time as a DVM degree (“Aquatic Animal Medicine Certificate,” n.d.).

**Licensing Examination**

In order to practice after graduation, students must pass the North American Veterinary Licensing Examination® (NAVLE®; “General NAVLE® Information,” 2014). Over the past 40 years, the goals of credentialing exams in regulated professions have shifted to ensure individuals possess the knowledge, skills, and abilities (KSAs) of job-related tasks (covering a range of activities in various settings) instead of focusing on the KSAs covered in the formal educational program (Raymond, 2005). A job analysis, also referred to as a practice analysis, is one of the most common ways of indexing the duties of a particular profession so that alignment can be made to KSAs covered on assessments and the level of appropriate emphasis can be determined to match real-world requirements (American Educational Research Association [AERA], American Psychological Association [APA], & National Council on Measurement in Education [NCME], 2014; Raymond, 2005). A licensing exam should not be viewed as static though, as evolution of the KSAs for a profession are expected in accordance with progress in scientific fields (including technological advancements), changing laws, and refinements in techniques (AERA, APA, & NCME, 2014). Additionally, the components
of licensing exams are not limited to technical KSAs and, furthermore, often include non-technical KSAs (MacCrate, 2004; “NAVLE® Test Specifications,” 2010; “United States Medical Licensing Examination® [USMLE®],” n.d.).

Comparisons to medical school are often made for veterinary medical education and, in fact, joint relationships have developed to the degree that the National Board of Veterinary Medical Examiners is overseen by a committee including members of the National Board of Medical Examiners (“General NAVLE® Information,” 2014). Although the medical board was involved with creating the last version of the NAVLE®, it is still fairly different from the USMLE®. For unsupervised veterinary practice a one-day assessment is given in their fourth year of school with 360 multiple-choice questions (“General NAVLE® Information,” 2014). Alternatively, the USMLE® is a three-step process starting after the second year of medical school and completed during residency training (residencies are three to eight years after medical school, depending on one’s specialty) and totals 1,200 multiple-choice questions, nine open-ended questions from computer-based case simulations, and eleven mock patient exams (“The USMLE® Exams,” n.d.). Thus, given this relationship, it is expected that future assessment methods for licensing veterinary medical professionals will include more rigor and practical, applied measures (such as mock cases) for a closer emulation of the USMLE®.

Post-Graduate Education

Formal continuing education courses are offered through professional associations (via annual conferences and online courses) and accredited universities (Hartman, Yanong, Harms, & Lewbart, 2006). However, veterinarians may also apply for formal internship or residency programs at a college of veterinary medicine to gain
specialized knowledge and skills in a particular field. Residency training programs and examinations of varying degrees exist for the 22 board certifications covering 40 specialties ("AVMA American Board of Veterinary Specialist," n.d.). AAH, referred to as "aquatic" by the American College of Zoological Medicine (ACZM), is one of four specialties within the ACZM board certification ("Structure of the ACZM Board Exam," 2013). The other three are general zoo, zoological companion animal, and wildlife ("Structure of the ACZM Board Exam," 2013). In order to be eligible for taking the ACZM exam, one must have their credentials approved by the board. Among other things, the credentialing packet outlines their training in the area to date (which must include a 3-4 year board-approved residency program or at least 6 years of experience working full-time in zoological medicine) and documentation of at least five peer-reviewed publications in the area ("FAQ," n.d.). Only a few institutions offer a board-approved residency training program emphasizing the aquatic specialty: North Carolina State University, University of Florida, University of Georgia, and the University of Illinois ("ACZM-Approved Training Programs," 2013; "Residency: Zoological Medicine," n.d.; "Zoological Medicine Residency," n.d).

**Job Market for Veterinarians**

Economic reports have shown high consumer spending on pet health, and there has been increased need for veterinarians, but there was also evidence of an excess of veterinarians (Brown & Silverman, 1999; Dall et al., 2013). Brown and Silverman (1999) found overall supply was deemed to be slightly higher than demand with about 74,000 full-time veterinarians but a need for only 73,500. Their model predicted supply would outpace capacity for the next fifteen years with a maximum gap of about 3,000 people, but demand would catch-up and balance with the supply at 83,000 veterinarians in
2014, and then demand will start to barely exceed supply in 2015 (Brown & Silverman, 1999). The report acknowledged there were indicators of opportunities for further market growth, especially in non-traditional and non-private practices (Brown & Silverman, 1999). Areas for expansion were identified in public health, environment, and food safety. However, it was also noted that, typically, veterinarians have not been recognized for these roles and have to compete with human medical doctors and other scientists (Brown & Silverman, 1999). Furthermore, industry was viewed as a major area of growth with about a 20% increase over 15 years. Disappointingly, Brown and Silverman (1999) did not include aquaculture species in their global food animal trade projections so the aquatic component for these major and minor growth predictions is unknown.

Since the Brown and Silverman study was conducted in 1999 and forecasted for 15 years, current data can be used to compare their predictions and assess the usefulness of such economic reports on capacity. As of 2012, the current veterinarian supply was estimated at 90,200 and demand at 78,950 (Dall et al., 2013). This oversupply of 11,250 veterinarians beyond the supply number estimated is likely due to increases in veterinary school class sizes that were calculated as stable by Brown and Silverman. Furthermore, and somewhat related, the reason the demand level fell short of predictions likely has to due to the unexpected economic downturn at the start of the millennium. While Dall et al. (2013) also predicted an increased demand for veterinarians with capacity reaching 88,060 veterinarians in 2025, given the current oversupply and estimates of supply numbers increasing annually, the job market looks increasingly troublesome. Thus, the marginal 1% growth in industry and food animal
sectors (Dall et al., 2013) seem insufficient. However, Dall et al. (2013) noted baseline data for the industry trends was limited and data used was from a survey “conducted during the middle of the economic downturn” (p. 57). Furthermore, the food animal projection was based on cattle, poultry, pig, and sheep production, so aquaculture implications were not included. Lastly, Dall et al. (2013) analyzed capacity by state and identified substantial differences from projections at the national level, which highlights the important of context in economic studies.

However, the Bureau of Labor Statistics shows the veterinary workforce for 2014 at 78,300 (U.S. Department of Labor, 2015). This is much lower than the Dall et al. (2013) estimation of 90,200. Additionally, their ten-year projection is more favorable with a 9% employment growth for veterinarians, 2% over the national employment growth projection (U.S. Department of Labor, 2015). The data collection sources were different for each group. The Bureau of Labor Statistics collects data monthly via survey of 146,000 organizations (Current Employment Statistics, n.d.). Alternatively, Dall et al. (2013) collected their information primarily through the AVMA database of veterinarians (which includes members and non-members) as well as other sources including the U.S. Census Bureau’s American Community Survey. The U.S. Department of Commerce oversees the Census Bureau and their data comes from monthly surveys of households (not organizations), for 2014 this totaled 2,322,722 respondents (“American Community Survey,” n.d.). Given the strict licensing oversight for veterinarians and the involvement of the AVMA COE in accreditation of educational institutions, it seems that the methodology of Dall et al. (2013) would lead to a more accurate supply estimation.
Job market predictions for AAH veterinarians. A prime example of where information has been lacking in the workforce needs of veterinary specialists was the lack of inclusion of zoological medicine practitioners, let alone aquatic animal health specialists, in the Hubbell, Richardson, and Heider (2006) study “Workforce needs for clinical specialists at colleges and schools of veterinary medicine in North America.” Only 19 specialty or sub-specialty areas were investigated which fell far from covering the 40 veterinary specialties and inadequately covered the overarching 22 board certifications. Other overlooked disciplines included clinical pharmacology, laboratory animal medicine, microbiology, pathology, and preventative medicine.

Hartman et al. (2006) described favorable job market conditions for aquatic animal health practitioners noting at least one full-time veterinarian is employed by most major public aquariums. In addition, Hartman et al. (2006) stated the aquaculture industry has increased commerce as well as expanded veterinarian opportunities (explicitly for aquatic animal pathologists), research interests have increased with fish and invertebrate species, and expansion in ornamental ponds worldwide has led to increased ownership of pet fish. A 2002 AVMA survey showed, per animal, there are about as many fish as pets in the United States (49.3 million) as there are pet dogs (52.5 million), and cats (57 million; Wise, Heathcott, & Gonzalez, 2002). Based on these observations, Hartman et al. (2006) projected continued expansion of the job market in this field.

Calls for Curricula Changes

Major restructuring of the four-year concept. Average total debt at graduation was reported by veterinary medicine students as being $151,000 (“Media Frequently Asked Questions,” n.d.), and salaries have lagged behind those of similar professionals
(Brown & Silverman, 1999; Cron, Slocum, Goodnight, & Volk, 2000). Furthermore, it is lower than some of the professions that require less years of higher education (Cron et al., 2000). The Association of American Veterinary Medical Colleges’ (AAVMC) 2006 Foresight Project report (“AAVMC Foresight report”) recognized the necessity for expansion in veterinary medical training to meet society’s changing needs while not significantly increasing the degree program length and reducing student debt (Willis et al., 2007). They noted it is socially irresponsible to significantly increase the length of training programs, and thus, student debt, when the return on investment is low (Willis et al., 2007). The report included a proposal for specialized training centers at accredited colleges throughout the country (instead of requiring each one to provide training opportunities in all areas) and a change in licensure to allow for focused competency assessment instead of the educational practice of covering all disciplines in the profession (Willis et al., 2007). Along these lines, they outlined an educational program where after two years of prerequisite training (currently an undergraduate program) students would enter a standardized (across all colleges of veterinary medicine) two-year veterinary core program, and then they could enter a two-year focused professional training program to graduate with their degree in veterinary medicine or enter a one-year comparative medicine program followed by a focused training program in order to graduate. In their proposal of possible pathways of focus, *Aquatic Animals* was included as one of eleven areas of professional focus, distinguishing it as a category separate from *Non-Traditional Animals*, *Zoo Animals*, and *Wildlife* (Willis et al., 2007). The report was followed with a strategic plan to achieve six goals:
1. Lead efforts to review, evaluate and improve veterinary medical education in order to prepare graduates with the competencies needed to address societal needs;
2. Lead efforts to increase the amount of veterinary research conducted and the number of graduates entering research careers;
3. Lead efforts to recruit a student body aligned with the demands for veterinary expertise;
4. Lead efforts to increase the number of racially and/or ethnically underrepresented in veterinary medicine individuals throughout academic veterinary medicine;
5. Lead efforts to develop the next generation of leaders for academic veterinary medicine; and
6. Strengthen AAVMC’s capacity to better serve its members, partners, and other stakeholders, in advancing the AAVMC mission. (AAVMC Strategic Planning Steering Committee, 2009)

It should be noted that while the proposal called for major curricula restructuring, it was not based on unprecedented recommendations for veterinary medical education. There have been multiple previous proponents for facilitating more career specialization within the veterinary medical degree curricula (Nielsen, 1997; Wise & Kushman, 1985); specifically, the seminal Pew report titled *Future Directions for Veterinary Medicine* (1989) which called for “Abandon[ing] the unrealistic concept of the universal veterinarian who can minister to the health needs of all creatures great and small.” Additionally, Bristol (2002) reported that when alumni were asked what they would have changed about their veterinary medical education, the top response (20% of all respondents) was for the ability to focus more on their own special interest track (i.e. discipline specialty). Turnwald, Sponenberg, and Meldrum (2008a; 2008b) described the veterinary medical education reform movement that started in the late 1980s as well as the failed attempt to agree on a national comprehensive curriculum however, they encouraged the profession to agree on broad learning outcomes and revisited the historical recommendations for centers of excellence (or emphasis) to capitalize on the unique elements at individual colleges.
Competency-driven curricula. The wide embrace of the AAVMC Foresight report in the veterinary medicine education community led to focused discussions of 400 stakeholders at three national meetings in 2010 and, ultimately, the development of five strategic goals and a list of core veterinarian competencies to address the changing societal needs (NAVMEC, 2011). The five strategic goals have been outlined as:

1. Graduate career-ready veterinarians who are proficient in and have the confidence to use an agreed-upon set of core competencies.
2. Ensure that admissions, curricula, accreditation, and testing/licensure are competency driven.
3. Share resources to ensure veterinary medical education is of the highest quality and maximally cost-effective.
4. Promote an economically viable education system for both CVMs and veterinary students.
5. Stimulate a profession-wide focus on innovation, flexibility, and action. (NAVMEC, 2011, p. 5)

The final report, titled *Roadmap for Veterinary Medical Education in the 21st Century: Responsive, Collaborative, Flexible (“NAVMEC Roadmap”),* also addressed needs for evolution of current veterinary medical education curricula to ones that are more competency-driven and highlighted the overall paucity of pedagogical information specific to the field (NAVMEC, 2011). The response to an open call for feedback on the draft version of the report came from 353 stakeholders, who may or may not have been involved in the creation of the recommendations (NAVMEC, 2011). Overall support for all of the recommendations equaled 75% for the academic community and 82% for the others, most of whom were identified as employers (NAVMEC, 2011). Furthermore, the strongest support (90%) was for the competency-based curricula recommendation (NAVMEC, 2011). The NAVMEC Roadmap competencies identified are as follows:

1. Multispecies knowledge and clinical competency in 1 or more species or disciplines;
2. One Health knowledge: Animal, Human, and Environmental Health;

One Health has been of increasing societal importance as about 75% of emerging human infectious diseases are zoonotic (Chaddock, 2012). The NAVMEC Roadmap stated veterinarians must capitalize on their comparative medicine skills and values for both the individual and population health of all species to become leaders in One Health (NAVMEC, 2011). The discipline partners veterinarians with professionals in other fields, such as public health specialists, biologists, hydrologists, and social scientists, to address global health concerns (Chaddock, 2012). Likewise, “Zoological medicine integrates veterinary medicine and the principles of ecology and conservation as applied in both natural and artificial environments” (Stoskopf, Paul-Murphy, Kennedy-Stoskopf, & Kaufman, 2001, p. 1532). Therefore, these two specialties are often highly intertwined.

In 2000, ACZM, supported by six other professional veterinary organizations and joined by representatives from all of the accredited colleges of veterinary medicine, conducted a workshop to provide educators with effective recommendations on “appropriate offerings in zoological medicine in veterinary curricula” (Stoskopf et al., 2001, p. 1532). In their review, 21 colleges offered some aspect of the topic in their required curriculum, and all offered a zoological medicine topic as an elective training opportunity (Stoskopf et al., 2001). Two educational goals were identified: first, to “provide basic knowledge and training to all veterinary students so that they fully understand the ramifications of zoological species in veterinary medicine today and in the future” (Stoskopf et al., 2001, p. 1532-33) and second, to “ensure that students at
every North American veterinary school have the opportunity to develop a level of competency adequate to successfully enter careers in zoological medicine” (Stoskopf et al., 2001, p. 1533).

A primary conclusion was “all veterinary schools [should] expect clinical competency in birds, reptiles, small mammals, and fish for all students intending to enter small animal practice” (Stoskopf et al., 2001, p. 1532). They added, at a minimum, elective opportunities (including dedicated allocation of time and resources) should be provided for didactic teaching and experiential learning in many zoological areas such as aquarium fish medicine, aquaculture, and marine mammal medicine (Stoskopf et al., 2001). Recognizing the challenges with curriculum changes, they addressed integration of these topics through case example modification in existing courses, creation of more online courses and summer short courses (along with increased facilitation of dual-enrollment and credit transfer), formation of faculty exchange programs, and development of a singular database to house elective opportunities in zoological medicine as well as “a comprehensive listing of goals, objectives, and training opportunities critical to entry-level competence…” (Stoskopf et al., 2001, p. 1534).

As with One Health training, the NAVMEC Roadmap was far from the first call for veterinary medical educators to increase training for development of professional competencies prior to graduation. These competencies have also been referred to in the literature as soft, life, employability, behavioral, or 21st-century skills and are non-technical (non-medical) competencies, distinct from technical competencies (or hard skills) which include the discipline-specific skills (Danielson et al., 2012; Robles, 2012; Turnwald et al., 2008b; Walsh et al., 2001). Accordingly, soft skills are applicable to all
career paths, not unique to a singular profession (Robles, 2012). Walsh et al. (2001) highlighted the importance of life skills (such as interpersonal competence and the desire to continuously learn) as factors for success at an increasing rate over technical skills. Furthermore, they emphasized the increasing prominence of outcomes assessment for all skills in the accreditation process of veterinary education programs because of the general need for alignment within the profession (Walsh et al., 2001). Modifying a document by the Medical Schools Objectives Project, Walsh et al. (2001) outlined 62 attributes in 3 categories (professional characteristics, knowledge and understanding, and skills) students are expected to demonstrate prior to graduation. All three categories include soft skills, or life skill, attributes with effective communication being the most dominant theme. Other advocates for adding soft skill curricula, including recent graduates themselves, often noted business skill development as a deficiency (Danielson et al., 2012; Hardin & Ainsworth, 2007; Lane & Bogue, 2010; Lewis & Klausner, 2003; Walsh et al., 2001). As Lewis and Klausner (2003) wrote:

> Given their role as gatekeepers to the veterinary profession, veterinary schools and colleges have the opportunity and responsibility to begin selecting for and developing those non-technical competencies associated with career success. Ideally, veterinary schools and colleges should consider offering relevant nontechnical training if it can be feasibly worked into the curriculum. If not, it may be useful to incorporate exposure to these skills into preceptorship or mentoring contracts. (p. 1694)

**Recent progress.** As one might expect given the lack of novelty in the recommendation themes, Andrews, Chaddock, and Osburn (2013) reported that many of the NAVMEC Roadmap recommendations were already being addressed by some of the CVMs even prior to the report’s publication and most had started initiatives to address implementation plans. However, multi-institution collaborations, which are necessary for execution of some of the NAVMEC Roadmap recommendations as well
as those proposed by Stoskopf et al. (2001) for improvement in zoological medicine education, were extremely limited. Encouragingly, all but one of the 19 associate deans surveyed responded they intended to use new learning techniques in the next academic year’s curriculum and students overwhelming (74%) desired these changes expressing specific interest in self-paced learning and removal of duplicative content from the curriculum (Andrews et al., 2013).

**Statement of the Problem**

It is unknown how well previous veterinary medicine research and trends for the veterinary medicine community as a whole are applicable to sub-specialties. Likewise, when trends have differed between sub-specialty or organizational type comparisons, the market outlook for a specialty such as AAH has been unclear. Workforce demands for AAH veterinarians is unknown, as is employer satisfaction with recent graduate performance. Furthermore, outcomes assessment data is not available for many specialty veterinary disciplines including AAH. For instance, common technical competency assessment methods may be adequate for those working predominately with mammals but not for those working with fish. Similarly, it is also unknown if recent graduates in AAH have the requisite soft skills to perform effectively at entry-level positions. Despite professional attention on curricula reform to better prepare (and encourage) veterinarians pursuing fields beyond traditional private practice, this lack of information means AAH specialists’ needs are not represented in veterinary curricula. While the area of zoological medicine, including AAH, is an important component of veterinary medicine education, the current curricula are cramped and any changes should focus on efficient and effective educational practices.
**Purpose and Objectives**

This study gathered the opinions of employers and recent graduates to ascertain:

*What components of veterinary medical education best meet the needs of aquatic animal health practitioners?* Specific objectives included to:

1. identify baseline job analysis duties and requirements;
2. determine employers’ perceptions of veterinary medical education areas needing improvement;
3. identify baseline job market and hiring characteristics;
4. determine employers’ perceptions of the job market outlook for future graduates;
5. identify the prevalence of different educational experiences (ex: didactic courses, externships, etc.);
6. determine recent graduates’ satisfaction with their aquatic animal health career;
7. determine recent graduates’ attitudes and perceptions of their own preparedness, barriers to preparedness, and areas needing improvement; and
8. identify divergences between employers’ and recent graduates' perceived needs and values of educational experiences, non-technical skills, and/or job market outlook.

**Significance of the Study**

There are 30 accredited colleges of veterinary medicine (including several with provisional accreditation status and those with minor and major deficiency notices) in the United States of America and 19 foreign accredited colleges, including eight in North America, six in Europe, and five in Australia and New Zealand (“Accredited Veterinary Colleges,” n.d.). This study will not only benefit the area of aquatic animal health education by providing insight to educators and students on workforce demands, career outcomes, and the job market but also provides support for overall veterinary curricula reform, such as that proposed in the 2006 AAVMC Foresight Project report. Specifically, job analysis data, in conjunction with practitioner item importance ratings and entry-level
performance gap analysis, can be used by students for more accurate career expectation-forming and to make more informed decisions when selecting elective education experiences, which are the primary educational opportunities for specialties. Similarly, recent graduates could compare these findings to their own educational experiences to identify the most beneficial continuing education opportunities, to overcome training gaps. Likewise, educators can use this data to inform curricula modification ensuring the most important topics receive adequate attention and all areas of interest to entry-level practitioners are addressed, so a curriculum becomes as efficient and effective as possible.

**Definition of Terms**

The following are operational definitions for terms used throughout this study:

- **CLERKSHIP**: supervised clinical practice experience gained at a university’s veterinary teaching hospital that qualifies for credit towards the veterinary medicine degree (typically performed over a year in two-week intervals where one rotates through the varied departments within the hospital).

- **COLLEGE OF VETERINARY MEDICINE**: accredited higher education institution providing veterinary medical training including, but not limited to, those using the term School of Veterinary Medicine.

- **DOCTOR OF VETERINARY MEDICINE DEGREE**: degree awarded for focused study in veterinary medicine beyond undergraduate coursework and including the Veterinariae Mediciniae Doctoris degree.

- **EXTERNSHIP**: an offsite (somewhere other than campus), supervised clinical practice experience of at least one week that qualifies for credit towards the veterinary medicine degree.

- **NON-TECHNICAL/SOFT/LIFE SKILLS**: the combination of people skills, or interpersonal qualities, and personal attributes, such as work ethic (Robles, 2012).

- **SHORT COURSE**: a mixture of lectures and laboratory/field experiences (labs) taught in an immersive all-day learning environment during the summer, usually lasting for one to four weeks, and offered to veterinary students as well as professionals.
• TECHNICAL SKILLS: discipline-specific skills (in this case, medical-related proficiencies).

• ZOOLOGICAL MEDICINE: “a discipline that integrates principles of ecology, conservation, and veterinary medicine and applies them to wild animals within natural and artificial environments” (Stoskopf et al., 2001, p. 1532).

Limitations and Assumptions

This study will use a purposeful sampling framework to survey employers representing the different areas of aquatic animal health veterinary practitioners: private practice (mainly fish medicine), government agencies, universities, non-profits (such as zoos/aquariums), and corporations (zoos/aquariums and others such as vaccine manufacturers). However, the total number of employers for this area is unknown since veterinarians are not typically classified to this degree of specificity and because not all employers are veterinarians themselves. Therefore, this study is limited in its ability to represent the perspective of all employers. Likewise, employers were used for recruitment of recent graduates so the same limitation in viewpoint representation applies here as well. Furthermore, it is assumed the respondents taking the time to complete the survey will answer thoughtfully and truthfully and, collectively, their views on the job market are an accurate approximation of reality.

Summary

Veterinary medical professionals have acknowledged that the shifts in societal need and technological advancement means veterinary medical education must evolve to cover more relevant topic areas and graduate professionals with critical thinking and problem solving skills as well as the drive and ability for life-long learning. Outcome assessment data is an important component of the formal education process and this study focused on identification of best practices for preparing veterinary specialists,
specifically AAH veterinarians, through the use of employer and alumni outcome assessment data. Job analysis and market information on AAH veterinarians was sought as well as the perceptions of employers on their most valued applicant experiences and the performance of recent graduate hires. Inquiries into most valued experiences and KSAs included both technical and non-technical competencies. Lastly, data was collected from the graduates themselves to assess whether there is agreement in performance and education perceptions and to identify key components that could be added/expanded in a curriculum to better meet needs. Findings from this study could be used to update existing veterinary medicine curricula and continuing education curricula as well as inform students’ elective choices and career path decisions.
The calls for veterinary medical curricula changes (such as creation of career track pathways for more specialized graduates, further integration of One Health concepts, and more emphasis on non-technical skills as described in Chapter 1) generally represent a newer professional perspective that curricula should be focused on preparation of practitioners for competency in addressing society’s needs in the 21st century. These needs are different than those of the previous decades and are predicted to continue to evolve, in keeping with the historical trend of the veterinarian’s role changing over time. As such, needs assessments and outcome evaluation are crucial components for revising a curriculum to align with the needs of the current society. In addition to the use of feedback in curriculum revision, details on employer and alumni satisfaction with career readiness, as well as their values of different skills and education experiences, can be used by individuals to guide their selection of the most beneficial elective and continuing education opportunities.

Outcomes Evaluation in Curriculum Planning

Wiggins and McTighe (2011) discuss the importance of outcomes-based curriculum planning (backwards curriculum design) by emphasizing “the heart of genuine expertise” lies in the “complex long-term performance where content is used, not from discrete topics or skills where content need only be recalled” (p. 7). The first two stages of their three-step backward design logic includes identifying desired results and determining acceptable evidence, respectively (Wiggins & McTighe, 2011). While the backwards curriculum design process emphasizes the importance of long-term outcomes, realistically, the design process is not strictly linear, and even forward design
processes may include outcome feedback from interest groups in initial planning phases (Conrad & Pratt, 1983; Richards, 2013). Along these lines, the North American Veterinary Medical Education Consortium (NAVMEC) Roadmap specifically noted one of its five missions was to engage employers of veterinarians in the development of their formal vision and recommendations for veterinary medical curricula and there should be “greater value on teaching outcomes in evaluating the performance of faculty at CVMs” (NAVMEC, 2011, p. 52).

This study is guided by Stake’s theory of responsive evaluation, which emphasizes the importance of collecting the diverse values that exist in complex systems with different stakeholder groups (Abma & Stake, 2001; Stake, 1976). While any consensus amongst the groups should be highlighted, differences in values between the groups are also important to recognize as the significance of any one curriculum component will vary for different stakeholders (Abma & Stake, 2001). Research of this nature is commonly done in a case study approach since significant situational details are needed to provide the appropriate context for interpretation of stakeholder views (Abma & Stake, 2001). Stakeholder groups, in this instance, refer not only to recent graduates and employers but also to the specific investigation of a specialist group within veterinary medicine, Aquatic Animal Health (AAH) practitioners. The ultimate goal of responsive evaluation is to drive change (or the retention of existing best practices, where appropriate) that reflects the mutual understanding and acceptance of stakeholders’ diverse values (Abma, 2005; Abma & Stake, 2001). Figure 2-1 shows the conceptual model of the inputs, process, and outcomes that guide this
study on identifying the essential curriculum components for preparing AAH veterinarians. These components and relationships are explored in further detail herein.

**Job Performance and Satisfaction**

**Employer Satisfaction**

Performance in entry-level positions is measured for the purpose of predicting future performance and, ultimately, improve the organization’s outcomes (American Educational Research Association [AERA], American Psychological Association [APA], & National Council on Measurement in Education [NCME], 2014). Across disciplines, from engineering to law to veterinary medicine, successful job performance includes effective execution of technical and non-technical tasks (Danielson et al., 2012; Lang, Cruse, McVety, & McMasters, 1999; MacCrate, 2004). However, the expectation is entry-level practitioners will not have mastered these tasks at this point in their careers; thus, practice analyses often include a need-at-entry index (AERA, APA, & NCME, 2014; Raymond, 2005). For example, Lang et al. (1999) presented findings from an industry survey asking for a rank-ordering of 172 experiences, knowledge descriptors, and skills that were associated with the eleven outcome categories of the engineering academy’s program outcomes and assessment criterion. The employers noted all items were more important for experienced engineers (those with three to five years of practice) than for entry-level engineers (Lang et al., 1999).

A meta-analysis by Viswesvaran, Schmidt, and Ones (2005) summarized nine dimensions of job performance: administrative competence, communication competence, compliance, effort, interpersonal competence, job knowledge, leadership, productivity, and quality. They included peer and supervisor evaluations of performance as best they could but noted correlations between the two in the literature were sparse,
as was further information on 360-degree style evaluations that also incorporate subordinate/customer performance reviews and self-assessments with the traditional employer performance evaluation (Viswesvaran et al., 2005). Thus, performance assessment categories are mostly evaluated with subjective ratings, except in instances like productivity where sales volume or some other quantitative category can be used. However, Wall et al. (2004) provided moderate convergent, discriminant, and construct validity evidence of the positive relationship between the two measures (where productivity and profit were used for objective job performance).

**Employee Satisfaction**

While the mediating and moderating factors of the job performance-job satisfaction relationship have not been isolated precisely, a positive relationship exists between the two distinct constructs (Judge, Thoresen, Bono, & Patton, 2001; Ng, Eby, Sorensen, & Feldman, 2005). Furthermore, realistic expectations are related to job satisfaction and, consequently, job performance and retention (Andrus, Gwinner, & Prince, 2006; Judge et al., 2001; Turnley & Feldman, 2000; Wendlandt & Rochlen, 2008). These expectations are likely to vary among different careers (Turnley & Feldman, 2000) but are often formed in the anticipation stage prior to starting in the position and thus, can be mitigated with proper career counseling (Wendlandt & Rochlen, 2008).

Several veterinary medicine studies report disparities between career expectations and reality which lead to shifts in career path in veterinary school and in early career stages (Andrus et al., 2006; Jelinski, Campbell, MacGregor, & Watts, 2009). Moreover, a longitudinal study with Australian veterinarians reported about half of the graduates did not strongly agree or even agree with the statement “If I had to ‘do
it over again’ I would definitely become a veterinarian” when surveyed five and twenty years after graduation (Heath, 1998, p. 184; Heath, 2007). Although, around 70% agreed or strongly agreed with “In general my career has lived up to my expectations” (Heath, 1998, p. 184; Heath, 2007). Thus, expectations and career path options are a significant aspect of the educator-student-employer dynamic and previous studies highlight the need for alumni viewpoints when conducting research in this area.

Although related to expectations, more tangible factors of veterinarian job satisfaction (in a farm animal setting) have included caseload, workload, and mentorship/colleague support (Jelinski et al., 2009). Subjective job satisfaction can be measured with a single, global-item approach with comparable reliability and validity to multifaceted approaches, such as the Job Description Index or Job Satisfaction Scale (Dolbier, Webster, McCalister, Mallon, & Steinhardt, 2005; Nagy, 2002). Job satisfaction is also often used as the subjective measure of career success (Ng et al., 2005). However, career success is often also measured by objective performance measures using salary level and promotion (Ng et al., 2005). Thus, job satisfaction and career success should be taken into consideration, along with measures of job performance, when evaluating veterinarian outcomes.

Veterinarian Job Performance and Employer Satisfaction

Studies on veterinarian employer satisfaction covered both technical and non-technical skill assessment. However, non-technical skills were addressed more commonly, and thus, more detail on this area is provided in the next section. Technical skills are often grouped into larger categories for assessment. The North American Veterinary Licensing Examination® (NAVLE®), which is based on its own Job Analysis, is organized into three sections (further details are shown in Appendix A) that cover 11
species taxa (canine, feline, equine, bovine, porcine, ovine/caprine, pet birds, other small animals, poultry, camelidae, and cervidae): (1) Data Gathering and Interpretation; (2) Health Maintenance and Problem Management; and (3) Professional Behavior, Communication, and Practice Management (“NAVLE® Test Specifications,” 2010). In comparison, the American College of Zoological Medicine’s (ACZM) Job Task Analysis Report identified nine subject area classifications in association with five species taxa (amphibians, birds, fish, invertebrates, and mammals) as representative of the breadth of the zoological medicine field: (1) Anatomy, Taxonomy, and Physiology; (2) Biologics and Therapeutics; (3) Communication, Education, and Administration; (4) Diagnostics; (5) Environment; (6) Medicine and Surgery; (7) Preventative Medicine; (8) Research; and (9) Restraint (“ACZM,” 2012).

Danielson et al. (2012) showed a positive relationship with nine items pertaining to employers’ satisfaction of recent graduates’ technical skills and twelve items related to non-technical skills. Technical skills items were categorized in the four constructs of data collection, data interpretation, planning, and taking action (Danielson et al., 2012). Taking action was identified as the best predictor of employer satisfaction and included items focusing on students’ level of preparation to perform relevant diagnostic tests, medical/surgical procedures, and aftercare (Danielson et al., 2012). However, none of those surveyed were involved with predominately exotic animal medicine.

Brown and Silverman (1999) reported that while 87% of recent graduates rated their clinical medical knowledge and clinical surgical skills as good to excellent, less than half of employers agreed. Furthermore, less than half of the private practice employers responded it was easy to somewhat easy to hire a veterinarian who is
adequate in these areas (Brown & Silverman, 1999). However, Butler (2003) surveyed alumni from Ontario Veterinary College, one year after graduation, as well as their employers and found graduates in each type of practice (equine, exotic animal, food animal, or small animal) were not equally viewed as having overall high clinical proficiency in specific competency areas. Upon review of nine clinical competencies, eight of which would be considered technical, employers tended to rate graduates in an exotic animal practice more evenly among the three performance-level categories (high, some, low) with a skew towards low performance (Butler, 2003). Exotic animal practitioners were viewed as only having high rates of competence relative to other practitioners in necropsy skills (60% rated high), and for this skill they tied with ratings for small animal practitioners. The other seven technical areas investigated were: (1) common health problems diagnosis and treatment; (2) formulating and ranking differential diagnoses; (3) animal rapport and handling skills; (4) critical care skills; (5) anesthesia skills; (6) promoting/providing health maintenance services; and (7) surgical skills (Butler, 2003).

Non-Technical Skills

The National Association of Colleges and Employers (NACE) surveys employers annually on the top skills and qualities they look for in new hires (NACE, 2005; NACE, 2010). The NACE lists for the 2006 and 2011 top-desired skills and qualities are presented in Table 2-1. The skills referenced can be categorized as soft or non-technical skills. The NACE top skill attributes mirror the majority of the qualities discussed in the veterinary literature. A summary of the non-technical skills discussed in the veterinary literature relative to the top NACE findings are presented in Table 2-2 (qualitative research) and Table 2-3 (quantitative research) and expanded upon herein.
Table 2-1. NACE 2006 and 2011 employer ratings (5-point scale where 1 = Not important and 5 = Extremely important).

<table>
<thead>
<tr>
<th>Rank</th>
<th>2006 candidate skill/quality</th>
<th>2006 weighted average rating</th>
<th>2011 candidate skill/quality</th>
<th>2011 weighted average rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Communication skills (verbal and written)</td>
<td>4.7</td>
<td>Communication skills (verbal)</td>
<td>4.65</td>
</tr>
<tr>
<td>2</td>
<td>Honesty/integrity</td>
<td>4.7</td>
<td>Strong work ethic</td>
<td>4.61</td>
</tr>
<tr>
<td>3</td>
<td>Teamwork skills</td>
<td>4.6</td>
<td>Teamwork skills</td>
<td>4.59</td>
</tr>
<tr>
<td>4</td>
<td>Strong work ethic</td>
<td>4.5</td>
<td>Analytical skills</td>
<td>4.56</td>
</tr>
<tr>
<td>5</td>
<td>Analytical skills</td>
<td>4.4</td>
<td>Initiative</td>
<td>4.50</td>
</tr>
<tr>
<td>6</td>
<td>Flexibility/adaptability</td>
<td>4.4</td>
<td>Problem-solving skills</td>
<td>4.48</td>
</tr>
<tr>
<td>7</td>
<td>Interpersonal skills</td>
<td>4.4</td>
<td>Communication skills (written)</td>
<td>4.48</td>
</tr>
<tr>
<td>8</td>
<td>Motivation/initiative</td>
<td>4.4</td>
<td>Interpersonal skills</td>
<td>4.40</td>
</tr>
<tr>
<td>9</td>
<td>Computer skills</td>
<td>4.3</td>
<td>Computer skills</td>
<td>4.38</td>
</tr>
<tr>
<td>10</td>
<td>Detail-oriented</td>
<td>4.1</td>
<td>Flexibility/adaptability</td>
<td>4.37</td>
</tr>
<tr>
<td>11</td>
<td>Organizational skills</td>
<td>4.1</td>
<td>Detail-oriented</td>
<td>4.18</td>
</tr>
<tr>
<td>12</td>
<td>Leadership skills</td>
<td>4.0</td>
<td>Technical skills</td>
<td>4.16</td>
</tr>
<tr>
<td>13</td>
<td>Self-confidence</td>
<td>4.0</td>
<td>Organizational skills</td>
<td>4.05</td>
</tr>
<tr>
<td>14</td>
<td>Well-mannered/polite</td>
<td>3.9</td>
<td>Leadership skills</td>
<td>4.04</td>
</tr>
<tr>
<td>15</td>
<td>Friendly/outgoing personality</td>
<td>3.8</td>
<td>Self-confidence</td>
<td>3.96</td>
</tr>
<tr>
<td>16</td>
<td>Tactfulness</td>
<td>3.8</td>
<td>Tactfulness</td>
<td>3.84</td>
</tr>
<tr>
<td>17</td>
<td>Creativity</td>
<td>3.6</td>
<td>Friendly/outgoing personality</td>
<td>3.72</td>
</tr>
<tr>
<td>18</td>
<td>GPA (3.0 or better)</td>
<td>3.5</td>
<td>Creativity</td>
<td>3.70</td>
</tr>
<tr>
<td>19</td>
<td>Entrepreneurial skills/risk-taker</td>
<td>3.2</td>
<td>Strong planning skills</td>
<td>3.35</td>
</tr>
<tr>
<td>20</td>
<td>Sense of humor</td>
<td>3.2</td>
<td>Entrepreneurial skills/risk-taker</td>
<td>3.19</td>
</tr>
<tr>
<td>21</td>
<td>---------------</td>
<td>---</td>
<td>Sense of humor</td>
<td>2.99</td>
</tr>
</tbody>
</table>
Table 2-2. Presence of important soft skills for veterinarians in previous (post-2000) qualitative research.

<table>
<thead>
<tr>
<th></th>
<th>Lewis &amp; Klausner (2003): Focus groups and interviews with veterinary professionals</th>
<th>Walsh et al. (2001): Expert panel with faculty and veterinary professionals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical/Critical thinking skills</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Business savvy</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Communication skills</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Computer/Technical skills</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Detail-oriented</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexibility/Adaptability</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Honesty/Integrity</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Motivation/Initiative</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Teamwork/Interpersonal skills</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Time management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work ethic</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Table 2-3. Presence of important soft skills for veterinarians in previous (post-2000) quantitative (predominately) research.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Analytical/Critical thinking skills</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
</tr>
<tr>
<td>Business savvy</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>Communication skills</td>
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<td>X</td>
<td>X</td>
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<td>X</td>
</tr>
<tr>
<td>Computer/Technical skills</td>
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<tr>
<td>Detail-oriented</td>
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</tr>
<tr>
<td>Flexibility/Adaptability</td>
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<td>X</td>
</tr>
<tr>
<td>Honesty/Integrity</td>
<td>X</td>
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</tr>
<tr>
<td>Motivation/Initiative</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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<td>X</td>
</tr>
<tr>
<td>Teamwork/Interpersonal skills</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Time management</td>
<td>X</td>
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<td>X</td>
</tr>
<tr>
<td>Work ethic</td>
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<td>X</td>
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</tbody>
</table>
While calls for updates to veterinary curricula to include more non-technical skill training has been previously discussed in Chapter 1, it should be noted non-technical skills are not valued equally throughout the curriculum and professional practice. Tinga, Adams, Bonnett, and Ribble (2001) found that while both technical and non-technical skills were highly valued by students and recent graduates, those in the first three years of school rated non-technical skills slightly lower than technical skills. The two skill sets were equally valued by fourth year students, however non-technical skills (termed professional skills in this study) were more valued by those who were one-year and five-years post-graduation (Tinga et al., 2001). Likewise, an older study conducted with Australian veterinary students documented shifts in views of importance (both more and less) for specific non-technical skills between their first year, final year, and two years post-graduation (Heath, Lynch-Blosse, & Lanyon, 1996). Overall in the veterinary literature, the most common identifications of skill inadequacies were for communication and business savvy skills. For example, Brown and Silverman (1999) reported 36% of industry employers noted specific job requirements were not met by a veterinary medical degree, thus, additional training would be needed for “speaking/writing, business/administration/personnel management, sales/marketing, financial and computer skills” (p. 176).

**Non-Technical Skills of Veterinarians**

Beginning alphabetically with analytical/critical thinking skills, “analytical skills” was used in the NACE survey and can be defined as “the abstract separation of a whole into its constituent parts in order to study the parts and their relations” (“Analytical thinking,” n.d.). In the veterinary literature, Lane and Bogue (2010, p. 64) describe critical thinking skills as “uses sound judgment, making decision on the basis of logic,
evidence, experience, and accepted practice, seeking information when needed.” Lewis and Klausner (2003) also list sound judgment as a competency with the same description plus the caveat of doing so in a timely manner. The American Psychology Association defines critical thinking as a “purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual consideration upon which that judgment is based” (Facione, 1990, p. 3). As Tsui (2002) discussed, both critical thinking and analytical skills can be related to problem-solving, however, disagreements persist over the definitions of each.

Walsh et al. (2001) included “reason deductively and critically to solve problems” as well as “critically examine new knowledge” (p. 1365), which alluded to the connection between them. Likewise, Kleine, Terkla, and Kimball (2002) used problem-solving and critical thinking as a single item on their survey instrument. It was the highest-ranked, non-technical skill item for teaching importance in veterinary school by alumni, employers, and faculty (Kleine et al., 2002). Danielson et al. (2012) simply used the term problem-solving as a non-technical skill for problems of a medical, as well as non-medical, nature. Given this, analytical/critical thinking was used as a combination for all of these elements, but with acknowledgment, as with all terms used, individual definitions vary.

Brown and Silverman (1999) reported veterinarian employers, in government, industry, and private practice sectors, view business skills as required for success in traditional veterinarian positions as well as those where the professional degree is not a prerequisite. Yet, alumni have reported they were unprepared in the business skills
category, noting there should be more curriculum coverage (Bristol, 2002), consistently ranking it their worst skill of all the categories (Hardin & Ainsworth, 2007), and valuing its importance more than employers and faculty (Kleine et al., 2002). Nevertheless, industry employers noted ‘business, administration, and personnel management’ as one of the top four areas of additional training veterinarians need to meet job requirements, and government sector employers listed ‘personnel management and administration’ as one category in their list of six areas needing additional development (Brown & Silverman, 1999).

Lane and Bogue (2010, p. 64) define business skills as “Is business oriented and understands resource management in meeting organizational goals.” Similarly, Danielson et al. (2012, p. 65) included “Perform the business-related tasks of the position” and “Control expenses and maximize revenue” as their two factors for business skills. Lewis and Klausner (2003, p. 1691) discussed the challenge of management, however, they also describe one challenge to success for veterinarians throughout different sectors of employment as “Obtaining business and political acumen-understanding how business works and how business goals are translated into action.” This take on the application of business knowledge seems to better reflect the personal attribute of a soft skill; thus, the term business savvy instead of business skills is used. The four foundations of business savvy are: (1) a deep understanding of the business model; (2) ability to generate insight using data; (3) impact through inquisitive, purposeful connection; and (4) leading with integrity, challenge, and consideration (Chartered Institute of Personnel and Development, 2012).
Along with being included in every document reviewed regarding for veterinary soft skills (Table 2-2), communication skills have been rated by employers in all fields as number one in their importance list since 1999 in the annual survey by the National Association of Colleges and Employers (NACE, 2005; NACE, 2010). Communication skills include both oral and written capabilities, in formal and informal contexts, as well as non-verbal language and listening (Department of Labor [DOL], n.d; Lane & Bogue, 2010; Robles, 2012). “Communication skills are important to everyone – they are how we give and receive information and convey our ideas and opinions with those around us” (DOL, n.d., p. 17). Communication is more than just how to convey information but also the interpretation of information that is received by others (DOL, n.d.). “Knowing our audience and understanding how they need to receive information is equally important as knowing ourselves” (DOL, n.d., p. 17).

Jelphs (2006) warns communication should not be undervalued just because it is a soft skill and not a technical skill. In healthcare, communication skills are emphasized in the context of both co-worker and client relationships (Danielson et al., 2012; Walsh et al., 2001). Jelphs (2006) posits improvements in communication could have the “greatest impact on effective healthcare delivery” (p. 33) as “Many of the errors and mistakes in healthcare are multifaceted, but nearly all have at their heart issues in relation to communication, miscommunication and assumption” (p. 37). Likewise, Martin (2006) commented that in his fourteen years serving on a complaints committee for the College of Veterinarians of Ontario, poor communication was the dominant theme in almost all of the 1,500 cases he reviewed. As with business skills, Brown and Silverman (1999) report veterinarian employers in government and industry sectors include
speaking/writing skills in their top six and four, respectively, areas of additional training needed to meet job requirements.

Furthermore, Tinga et al. (2001) reported fourth-year students did not feel competent or comfortable in many communication situations, such as delivering bad news to a client (30% and 45%, respectively), dealing with demanding people (30% and 43%, respectively), and interpreting non-verbal behavior (26% and 30%, respectively). These inadequacies were somewhat resolved over time, however, incompetence and uncomfortableness with delivering bad news was still reported by 10% and 25%, respectively, of people one- and five-years post-graduation (Tinga et al., 2001). Many recent graduates were also uncomfortable dealing with demanding people (37%) and interpreting non-verbal behavior (20%; Tinga et al., 2001). Breaking bad news and handling aggressive patients are purported as higher-order communication skills by Aspegren and Lønberg-Madsen (2005); thus, persistence in feelings of incompetence and uncomfortableness are not surprising, even after some skill training and experience. Nevertheless, Kogan et al. (2004) reported students participating in a curriculum with required courses on client relations and communication as well as elective, active learning opportunities reported an overall high level of comfort (85.5%) with higher-order client scenarios. Additionally, those who had participated in the elective also reported higher use of client relations procedures (Kogan et al., 2004).

Interestingly, when alumni, employers, and faculty were surveyed on the importance of different items for inclusion in the veterinary curriculum, oral communication was rated above written communication (Kleine et al., 2002). In another survey, verbal communication with clients was listed specifically with eight technical
competencies and, perplexingly, employers of exotic animal practitioners rated them as having the overall lowest proficiencies when compared to veterinarians in food animal, small animal, and equine practices (Butler, 2003). Employers responded only 40% of exotic animal practitioners had high verbal communication proficiency which was a tie with equine practitioners but lower than food animal (60% were high) and small animal practitioners (80% were high). However, exotic animal practitioners’ self-assessments were even lower than their employers’ assessments with only 10% self-reporting high clinical proficiency (55% reported some and 35% reported low; Butler, 2003), which is in and of itself concerning. Lane and Bogue (2010) noted, in 2006, communication skills were added as a college of veterinary medicine accreditation standard.

Walsh et al. (2001, p. 1365) referenced computer/technical skills in their attribute of “A competence in information technology to be able to access and retrieve accurate biomedical information, diagnostic strategies, and medical records from electronic databases and other resources.” Technical skills in this context is a reference to technology skills and not to the hard skills specific to the veterinary medical profession; thus, the grouping with computer skills and inclusion as one of the soft skills. In addition to its listing in the NACE surveys, the use of computers to process information, appropriate selection and application of technology for different tasks, as well as general maintenance and troubleshooting of technology are listed as 20% of the core competencies in the Skills and Tasks for Jobs report (DOL, 1999). Along with business and speaking/writing skills, as mentioned previously, Brown and Silverman (1999) reported veterinarian employers in government and industry sectors included computer
skills in their top six and four, respectively, areas of additional training needed to meet job requirements.

In post-2000 literature, the most closely related discussion of “detail-oriented” as an important soft skill for veterinarians is in the keeping of medical records, particularly in accordance with legal requirements (Danielson et al., 2012; Walsh et al., 2001). However, one older research study, conducted longitudinally with Australian veterinary medical students in the late 1980s, reported most first year students viewed “A capacity for meticulous attention to detail” as very important (60%) for successful veterinarians but only 17% felt as strongly in their final, fifth year, and then, two years after graduation, 31% responded it was very important (Heath et al., 1996, p. 299). Detail-oriented was included in this study mostly because it consistently ranked as a top ten skill for employers in the NACE studies (NACE, 2005; NACE, 2010).

Lane and Bogue (2010, p. 64) define flexibility as “Demonstrates adaptability and resilience by staying optimistic and using a range of skills to handle challenges.” Similarly, Lewis and Klausner (2003) list adaptability and resilience with the qualities of:

- Responds to competing demands or abrupt changes with a positive outlook
- Stays optimistic and resilient in the face of adversity, change, and ambiguity
- Uses a large repertoire of skills, experiences, and behaviors to handle a wide variety of challenges and opportunities. (p. 1696)

Relatedly, Walsh et al. (2001) describe the need to be tolerant of conflicting views, as well as having the openness and flexibility to accept change. They go on to propose the attribute of “being an advocate for change to meet the goals of the profession” (Walsh et al., 2001, p. 1364). Together, these seem to bridge the qualities of adaptability/flexibility, initiative, and interpersonal skills.
Walsh et al. (2001) note veterinary students should have demonstrated honesty and integrity in their interactions with everyone they encounter in their professional experiences—from colleagues to clients. Honesty/integrity is defined as “can be trusted; recognizes when faced with making a decision or exhibiting behavior that may break with commonly held personal or societal values; understands the impact of violating these beliefs and codes on an organization, self, and others and chooses the ethical course of action” (DOL, 1999, p. 2-10). Honesty can also be defined as “truthfulness, sincerity, or frankness” (“Honesty,” n.d.). Walsh et al. (2001) contextualize these attributes to knowledge limits of veterinary students with their description of “intellectual honesty to recognize and accept limitations in their own knowledge and clinical skills…and integrity to seek consultation and referral” (p. 1364-1365). More generally, Lewis and Klausner (2003) define demonstrating integrity as:

- Acts in a manner consistent with the principles of the veterinary profession and the courage of one’s convictions
- Builds trust with others through daily actions and decisions
- Increases one’s credibility by treating others with respect
- Makes principled decisions. (p. 1696)

In a Delphi method study with animal science experts, being honest was unanimously rated first as the most important non-technical skill entry-level (high school graduates with coursework experience in agricultural, food and natural resources) employees needed (Slusher, Robinson, & Edwards, 2010).

Lane and Bogue (2010, p. 64) describe interpersonal skills as “builds relationships and trust with others by demonstrating interest in their concerns, valuing their perspectives, and treating them with respect.” Lewis and Klausner (2003) also included these elements and added making others feel comfortable during interactions,
acting in a genuine manner, and, specifically, building a network of colleagues. The sentiment of comfort is echoed by Lane and Bogue (2010) in another capability, cultural competence—demonstrated awareness of cultural sensitivity. Relatedly, “Teamwork involves building relationships and working with other people using a number of important skills and habits,” including respect for differing customs (DOL, n.d.). Interestingly, only 2% of fourth-year veterinary students surveyed by Tinga et al. (2001) responded they were not competent at working as a team member. Teamwork, classified under interpersonal skills, was ranked as the most critical competency across 35 different jobs (DOL, 1999). It is described as:

Participates as a Member of a Team - Works cooperatively with others and contributes to group with ideas, suggestions, and effort. Demonstrating competence in participating as a member of a team includes doing own share of tasks necessary to complete a project; encouraging team members by listening and responding appropriately to their contributions; building on individual team members’ strengths; resolving differences for the benefit of the team; taking personal responsibility for accomplishing goals; and responsibly challenging existing procedures, policies, or authorities. (DOL, 1999, p. 2-5)

Encouragement of team members was referenced as coaching and developing others in both Lane and Bogue (2010) and Lewis and Klausner (2003).

Lane and Bogue (2010, p. 64) describe the competency of motivation and persistence as “drives for results with focused goals, with persistence, and in the face of multiple tasks.” References to motivation/initiative as an important soft skill in other veterinary publications were mostly focused on self-development for continuous improvement to their knowledge and learning (Kleine et al., 2002; Lewis & Klausner, 2003; Walsh et al., 2001). However, in addition to showing the importance of life-long learning behaviors to alumni, employers, and faculty, Kleine et al. (2002) found faculty rated initiative and motivation as having significantly higher importance for success as a
veterinarian than employers. Relatedly, alumni, employers, and faculty unanimously responded (3.72 average of the three groups on a four-point scale) a positive work attitude is critically important for success in any veterinary position (Kleine et al., 2002).

Time management was ranked as the second-most critical competency, after teamwork, in a review of 35 jobs by the DOL (1999). They described it as:

*Allocates Time* - Selects relevant, goal-related activities, ranks them in order of importance, allocates time to activities, and understands, prepares, and follows schedules. Competent performance in allocating time includes properly identifying tasks to be completed; ranking tasks in order of importance; developing and following an effective, workable schedule based on accurate estimates of such things as importance of tasks, time to complete tasks, time available for completion, and task deadlines; avoiding wasting time; and accurately evaluating and adjusting a schedule. (DOL, 1999)

Tinga et al. (2001, p. 925), used “setting time limits yet providing quality service” in their instrument and found many fourth-year students did not feel comfortable (38%) or competent (36%) with their abilities in this area and some recent alumni, one- to five-years post-graduation, also felt uncomfortable (17%). Kleine et al. (2002) found alumni, employers, and faculty all have a similar rating of importance (important over somewhat important) for schools to provide time management skill training. However, in contrast to these findings, Root Kustritz and Nault (2010) reported students found the time management module unnecessary in their veterinary professional development curriculum.

Strong work ethic appeared fourth on the 2006 NACE list and second in 2011 (NACE, 2005; NACE, 2010) as well as second in a Delphi study on entry-level non-technical skills needed for careers in animal science (Slusher et al., 2010). Work ethic encompasses the characteristics of being hard-working, self-motivated, loyal, and reliable (Robles, 2012). Slusher et al. (2010) provided the examples of responsible,
accountable, and dependable for demonstration of a strong work ethic. Of the 50 items in the Occupational Work Ethic Inventory, Hill and Petty (1995) identified three overarching factors of work ethic characteristics: interpersonal skills (top-loading items were courteous, friendly, and cheerful), initiative, and dependability. Although the term work ethic was used in this study, teamwork/interpersonal skills and motivation/initiative were also included as a separate items because of their individualized inclusion in the NACE research and specific mention in the veterinary research. The veterinary literature did not specifically use the term work ethic but did mention core elements (as shown in Table 2-2).

**Communication Skill Development in Veterinary Curricula**

Not only has communication been identified as one of the most important non-technical skills (by sheer frequency of the theme over the years) and viewed as a shortcoming in many graduates (Brown and Silverman, 1999; Tinga et al., 2001), communication is also one of the few skills where in-depth research has been conducted on skill development (Adams & Kurtz, 2006; Adams & Kurtz, 2012; Chun, Schaefer, Lotta, Banning, & Skochelak, 2009; Shaw & Ihle, 2006; Tinga et al., 2001). Like many educational trends in veterinary medicine, communication skill development has been adapted from findings in human medical education studies (Adams & Kurtz, 2006; Adams & Kurtz, 2012; Chun et al., 2009; Shaw & Ihle, 2006; Tinga et al., 2001).

Aspegren and Lønberg-Madsen (2005) illustrated the importance of specific communication training with their findings that after ten years of practice, medical professionals who had not received this training showed many process, as well as some perceptual, communication skills deficits. Curricula emphasis should be on opportunities
for practice and refinement in the skill development process, not just awareness of

Tinga et al. (2001) also stressed veterinary students must feel comfortable
discussing emotional issues with instructors in order to build their non-technical skills.
Overall, “feelings of professional competence were highest in participants who felt the
most comfortable discussing emotional veterinary issues with their instructors” yet
“quarter to a half of each group did not feel comfortable about the learning environment
with respect to discussions with instructors” (Tinga et al., 2001, p. 929). Furthermore,
integration across the curriculum, in a variety of ways, is encouraged for maximum
effectiveness (Adams & Kurtz, 2006; Adams & Kurtz, 2012; Burns, Ruby, DeBowes,
Seaman, & Brannan, 2006; Chun et al., 2009; NAVMEC, 2011; Root Kustritz & Nault,
2010).

The *Teaching and Learning Communication Skills in Medicine* text and the
associated *Calgary-Cambridge Observation Guide* serves as the foundation for much of
the communication competence curricula (Adams & Kurtz, 2006; Adams & Kurtz, 2012;
Chun et al., 2009; Shaw & Ihle, 2006). Bayer Animal Health has also sponsored the
development of instructional materials on an array of communication topics and faculty
from most of the veterinary schools in North America have received training on delivery
of these modules (Turnwald et al., 2008b). With any curriculum, though, coaching (i.e.
teaching) skills are necessary to build communication competence and even effective
communicators may not possess the skills necessary for teaching communication (or
lack comfort with the facilitator role) which is why training, in the form of faculty
professional development, is extremely important for success (Adams & Kurtz, 2012;
Root Kustritz & Nault, 2010; Tinga et al., 2001). Adams and Kurtz (2012) described an agenda-led, outcome-based analysis for providing feedback (mostly through the Socratic method, or guided discovery learning) on role-play scenarios and simulations. The agenda, as described by Adams and Kurtz (2012), should be student-centered, with primary focus on the learner’s previously-identified goals. In veterinarian-client scenarios, the outcomes are three-fold, as students’ are asked to reflect on their desired outcomes plus the client’s and the animal’s needs throughout the interaction (Adams & Kurtz, 2012).

Adams and Kurtz (2012) noted many challenges in veterinarian communication competence building; chiefly, learners must overcome pre-conceived notions and existing habits, and coaches have often just recently honed their own skill set from continuing education training on how to teach effective communication skill development. Chun et al. (2009) also noted many challenges but credited an innovative partnership with the School of Medicine and Public Health and the School of Education at their university as essential in their obtainment of sufficient resources for integration of both didactic and experiential learning elements into each year of their four-year veterinary curriculum. Focusing on the assessment of professional competency development, Hodgson, Pelzer and Inzana (2013) advised the veterinary medicine education community to continue to model the human medical field and implement a multifaceted assessment program comprised of formative assessment activities that balance the reliability of simple task evaluation with the validity of performance reviews in complex situations, where multiple skill sets must be integrated, so habitual competency achievement can be documented. The primary assessment model
Theoretical and Conceptual Framework

As previously mentioned, this study was guided by the established use of outcome data, collected from both alumni and employers, to influence and improve curriculum efficacy (Abma & Stake, 2001, Conrad & Pratt, 1983; NAVMEC, 2011; Richards, 2013; Wiggins & McTighe, 2011). Figure 2-1 is a model of the relationship between the starting point of the Doctor of Veterinary Medicine (DVM) curriculum and the outcomes of performance and satisfaction. The relationship between job performance and satisfaction can be explained in terms of both the employer and alumni/employee viewpoint.

On the employer side, performance is directly linked to satisfaction; however, expectations are lower with entry-level positions. The employee performance-satisfaction relationship has been shown to be more complicated, with both factors positively affecting each other. Beyond curriculum reform, satisfaction data can also be utilized by students to shape their career expectations and inform elective course participation decisions. Student career expectations can also be shaped by career counseling, mentorship, and professional development courses within the veterinary curriculum. Thus, a single-headed arrow from student career expectations to
performance was used, but the relationship with DVM education was illustrated with a double-headed arrow. Likewise, the same arrows were used with non-technical skills to explain that relationship with education and performance.

The importance of non-technical skills for veterinarians was covered in depth, including impacts on job performance and increased efforts for topic coverage in the curricula. Elaboration on the development of effective communication skills was added as an example to show the variety of approaches for incorporation of a non-technical skill into a curriculum, the challenges associated with complex skill development (especially, when an existing skill is based on bad habits), and the shortcomings in current assessment methods. Lastly, technical skills are shown in the center. Technical skill development is the primary driver of the curriculum and the essential driver of veterinarian job duties. All of these elements must be factored into decision-making for curriculum reform and, given the time and financial resource limitation of students, priorities must be established.

Summary

Responsive evaluation can be used to guide curriculum reform through the collection of job performance data from both employers and recent graduates. Job performance serves as the primary confirmation of intended outcome gains in curriculum evaluation criteria. Both subjective (ex: employer satisfaction) and objective (ex: merit-based raises) measures of job performance can be considered as evidence of technical and non-technical competency in overall job duties. However, identification of specific gaps is key for efficient and effective curriculum modification. Conflicting employer opinions have been shown for clinical medical knowledge and surgical skills, however, exotic animal practitioners have been rated as less technically proficient than
veterinarians in equine, food animal, or small animal practices. Moreover, communication and business skills are viewed by employers and employees as the largest non-technical skill deficiency. However, there is no data on the non-technical skills of AAH specialists (or even Zoological Medicine veterinarians). Lastly, employee satisfaction is also known to have a positive correlation with job performance and student career expectations have been shown to impact that dynamic. So, information on the job performance and career satisfaction of recent graduates can provide more realistic career expectations of students as well as inform students and veterinary educators of traditional gaps in entry-level knowledge and skills for amelioration.

Figure 2-1. Conceptual model of the relationship between veterinary medical education and early career outcomes. (Dashed lines represent feedback impacts.)
CHAPTER 3
METHODOLOGY AND PROCEDURE

As discussed in Chapters 1 and 2, veterinary medical curricula reform has received significant attention within the profession as educators attempt to respond to changing societal needs and conditions. Obtainment of outcome assessment data has been emphasized as an important component of curricula assessment and revision. Without information on employers’ needs and student preparedness upon graduation, educators cannot appropriately adjust curricula or mentor students. Previous efforts to provide these data have been focused on entry-level, small and large animal practitioners. Thus, the needs of Aquatic Animal Health (AAH) veterinarians are unknown and, subsequently, not included in current curricula evaluations. The focus of this study was to identify the key curriculum components essential to preparing veterinarians specializing in aquatic animal health. Recognizing the role of education in technical and non-technical skill development (as well as career expectations) to graduate performance and, thus, graduate and employer satisfaction, the following objectives were outlined:

1. identify baseline job analysis duties and requirements;
2. determine employers’ perceptions of veterinary medical education areas needing improvement;
3. identify baseline job market and hiring characteristics;
4. determine employers’ perceptions of the job market outlook for future graduates;
5. identify the prevalence of different educational experiences (ex: didactic courses, externships, etc.);
6. determine recent graduates’ satisfaction with their aquatic animal health career;
7. determine recent graduates’ attitudes and perceptions of their own preparedness, barriers to preparedness, and areas needing improvement; and
8. identify divergences between employers’ and recent graduates’ perceived needs and values of educational experiences, non-technical skills, and/or job market outlook.

Epistemological Assumptions

Curriculum design research is a complex issue (e.g. limited timeframe for many important topics with multiple stakeholder influences), as is much of social science research. Since no one stakeholder group is expected to be completely satisfied with the final product, it is important to incorporate the student view to help contextualize any dissatisfaction and recommendations for change. With this in mind, this study used a sequential, explanatory model as the research design. Creswell and Plano Clark (2011) discussed the need in some instances for shifting worldviews during phases of the research plan. Herein, the worldview is shifting from Post-positivism to Constructionism as multiple realities are introduced and used in a sequential, explanatory model.

Overall Research Design

This sequential, explanatory mixed methods study began with a novel, online questionnaire to survey the perspectives of employers on how aquatic animal health workforce preparedness can be improved (Objective 2). Additionally, to satisfy the first, third, and fourth objectives, the instrument was also used to collect job analysis and market data as well as survey employers on their perceptions of the job market outlook for future graduates. The focus of this portion of the study (Phase 1) was to gather a variety of opinions from different sectors to identify commonalities but not to force a consensus, such as the goal of the Delphi method (Stitt-Gohdes & Crews, 2004). Measurement of this variety is best accomplished with quantitative techniques following the scientific method, since quantitative measurement allows for obtaining the breadth of information needed to answer the research question (Creswell, 2012).
Next, the survey data were analyzed and the results were used to create an online questionnaire (for surveying the perspectives of recent graduates) and then, a semi-structured interview guide (for more detail). The survey instrument for recent graduates (Phase 2) was used not only to address the last four objectives but, also as a screening instrument for choosing interview candidates (Phase 3). The interview guide was used to help facilitate inquiry into explanations for disparities (Fossey, Harvey, McDermott, & Davidson, 2002) between the curriculum experienced by alumni and level of workforce preparedness expected by employers. Additionally, thick descriptions collected during qualitative research methodology add depth to the explanation of the quantitative findings that cannot otherwise be captured (Creswell & Plano Clark, 2011). From this, meta-inferences can be made for a larger interpretation about the issue (Creswell & Plano Clark, 2011). In summary, Phase 1 and 2 consisted of quantitative outcome data collected from two different stakeholders, and Phase 3 was the qualitative portion of the study where further explanations were sought from the recent graduates. Prior to any data collection, study proposals for each stakeholder group were approved by the University of Florida’s Institutional Review Board (#: 2013-U-1219 and 2015-U-0976).

Quantitative Methods: Phases 1 & 2

Phase 1 Participants: Employers

The focus of this study is on positions obtained by graduates from veterinary schools in the U.S., so the majority of employers (AAH professionals who could potentially hire a recent graduate) included in the purposeful sample worked in America. Given the breadth of the AAH field, representatives (n = 94) were selected from five predominant areas including government agencies (n = 21), universities (n = 16), small
businesses such as private practice and independent contractors \((n = 21)\), non-profits such as zoos/aquariums and rehabilitation facilities \((n = 20)\), and corporations such as zoos/aquariums and vaccine manufacturers \((n = 16)\). Dall et al (2013) reports for 2008 – 2011, females represented 78% of enrollment. However, because the field was previously male dominated, the current ratio for practicing veterinarians is about 50:50 (Dall et al., 2013). Of the 94 employers, males were slightly over-represented at 60% \((n = 56)\). As it is a relatively small field, e-mail addresses for all of the employers invited to participate were known by the researchers involved (including veterinarians at the University of Florida) or obtained from the member directory of the most relevant professional society, the International Association for Aquatic Animal Medicine. Additionally, gender was not included in the instrument, so sex was recorded post hoc by the researcher based on personal knowledge and online information gathering from name searches.

**Phase 2 Participants: Recent graduates**

Recent graduates are defined as those who matriculated between 2008 and 2014. These alumni were recruited through recommendations from the employers who responded in Phase 1 of the study. The participating employers were asked to provide contact information for their recent graduate hires over the past five years (including interns and residents) or forward the survey instrument to them. Invitations to participate were sent to every person recommended \((n = 23)\) since the population is small. The data collection period was open long enough (2 months) to ensure respondents represented each of the five fields, as categorized in Phase 1 with the employers, to retain full representation of viewpoints in the diversity of career paths. As described previously, sex was recorded by the researcher post hoc.
Survey Instruments

Due to a lack of research on the topic, a 41-item instrument (see Appendix B) was created with input from veterinarians and evaluation specialists to measure the first four objectives. Comparison data were also gathered for the last objective. Additionally, the instrument contained six items at the end that were outside the scope of this project; they related specifically to the respondents’ awareness and familiarity with a specific educational opportunity at the University of Florida. The questionnaire was implemented online and used adaptive feedback, so the respondent’s answers impacted the presentation of specific questions (thus, some questions were skipped for irrelevancy to certain respondents). All items had finite response choices (ex: Likert-type scale, rank, multiple choice) except for the last question asking for other comments (in a free-form text box).

As discussed in Chapter 2, the American College of Zoological Medicine’s (ACZM) Job Task Analysis Report identified nine subject area classifications and five species taxa for this field. These were included as categories in the survey for technical knowledge and skills. The literature review of non-technical skills important in veterinary medicine returned lengthy lists. Since the employer view of non-technical skills was only a portion of the objectives included in the survey instrument and length of the survey needed to be minimized to facilitate maximum completion rates (Dillman, Smyth, & Christian, 2009), the categories for this section needed to be limited. Therefore, the soft skills were categorized and compared to eleven groups based on top ratings in the National Association of Colleges and Employers’ studies (Table 2-1, 2-2, and 2-3) ensuring inclusion of the most frequently referenced attributes in this instrument.
The 36-item instrument (see Appendix C) for surveying the recent graduates was created after the data analysis of the employer questionnaire. Many questions \((n = 15)\) were duplicated from the employer survey instrument with only minor tweaks to the wording to reflect the different stakeholder group. Other questions were included for either demographic data collection purposes or to address the last four objectives. All other aspects of the instrument were the same as the employer survey instrument.

**Validity and Reliability**

Since purposive sampling was used to ensure the questionnaires reached participants who have hired aquatic animal health veterinarians (which is not tracked in a database for random sampling), selection bias is a known threat to the study’s validity. The addition of the alumni data should help to combat this threat as it will provide a form of triangulation. Additionally, the survey instruments underwent face and content validity assessments with expert panel reviews (composed of university faculty); plus, the employer survey instrument was also reviewed and supported by the American Veterinary Medical Association’s Aquatic Veterinary Medicine Committee. Furthermore, prior to implementation of the employer survey instrument, three beta tests were completed with professionals in different sectors to test usability, including phrasing and inclusion of all necessary answer choices. The first questionnaire was conducted in a think-aloud style where the respondent completed the online survey while on the phone with the primary researcher verbalizing what they were thinking during each question. Adjustments were made and another think-aloud questionnaire was completed, as well as an instance were the instrument was completed without the researcher present so issues/concerns were reported to the researcher after completion of the questionnaire. Only minor edits were made thereafter.
The external validity threat of non-response error is discussed in the next section. Lastly, questions were posed in the questionnaires in a multitude of ways so answers could be compared for consistency. For example, the skills included in a question asking about most important non-technical skills were presented in random varying orders to different participants.

**Data Collection and Non-Response Error**

Recruitment of participants to complete the questionnaires occurred through their work e-mail addresses (whenever possible) during business hours. The personalized invitation e-mails (see Appendix D) with a link to the instrument, hosted by Qualtrics, came from a colleague with a university domain name. For the employers, the e-mail included notice they had been selected to participate based on their history in the field and the survey was designed in collaboration with recognized professional organizations (also noted at the beginning of the instrument itself). Recent graduates were informed they had been recommended by a current or former employer or they received the invitation to participate via a forwarded e-mail from the employer directly. Reminder e-mails were sent, one week apart from previous contact, only to those who had not yet completed the questionnaire (the first reminder was sent in the morning and second was sent in the afternoon to maximize the completion rate based on varying busy times of the day). Showing trustworthiness (through a university domain name) and organizational sponsorship is known to decrease the non-response error, as are reminders (Dillman, Smyth, & Christian, 2009). Additionally, late respondents (those who replied after the second reminder) were compared to early respondents (those who replied before the first reminder) and no differences were found, suggesting non-respondents do not differ from respondents.
Data Analysis

The employer survey instrument was designed, implemented, and analyzed prior to development of the recent graduate survey instrument. Descriptive statistics (i.e. frequencies, central tendencies, and variability) were carried out on the resulting data using SPSS. The free-text comments were analyzed for themes using the constant comparative method. The demographics used for independent (i.e. grouping) variables in the employer questionnaire included length of AAH career, degrees held, and type of organization in which they are employed. The last two were also used as independent variables in the recent graduate analysis, along with participation in an internship or residency.

The research objectives guided the dependent variables of interest. Investigation of employer views on educational areas needing improvement included questions on non-technical skills, such as identifying the importance of each skill and selecting the top three needing improvement, as well as technical skills, such as asking about knowledge/experience needs for different species taxa and having them choose the most important subject areas for successfully meeting job duties. Likewise, recent graduates were also asked about non-technical and technical skills in relation to their needs in their first AAH position. Furthermore, preparedness was also gauged using their overall satisfaction with their veterinary medical education. Career satisfaction was assessed using their job satisfaction, merit-based raise/promotion information, and likelihood to repeat pursuit of the career path.
Reflexivity

As a 32 year-old, white, female I am similar in profile to the majority of modern veterinary school graduates. Although not a veterinarian, I have always been interested in the field and have worked extensively in veterinary medicine, including AAH. My Associate of Arts degree is in Pre-Veterinary Medicine, my Bachelor of Science degree is in Wildlife Ecology and Conservation with a second major in Animal Science, and my Master of Science degree is in Veterinary Medical Science. During my undergraduate studies, I started working for the College of Veterinary Medicine (CVM) at the University of Florida. After a few years predominately in small animal medicine (with some equine and zoological medicine experience), I started working in an AAH research laboratory, and then also for the AAH program including assisting with course preparation and delivery. I pursued my master’s degree in that AAH laboratory as a way of improving my application to veterinary schools. Since I was never accepted to veterinary school, I accepted a promotion in the AAH program that required skill sets in program administration.

These experiences culminated in a shift in my professional goal of becoming a clinical veterinarian specializing in exotics to a college administrator. While continuing to work full-time, I began my Doctorate of Philosophy studies in Agricultural Education and Communication on a part-time basis and I immediately expressed my desire to minor in Higher Education Administration. I felt obtaining a PhD degree in pedagogy was crucial to becoming an academic administrator but I wanted to keep an emphasis on my scientific background as the foundation for my administrative career. My experiences at the University of Florida exposed me to the lack of evidence-based teaching practices in
course development and delivery. For the most part, professors are subject-matter experts and have little, if any, formal education in teaching practices. Furthermore, evaluation of teaching efficacy was almost non-existent and teaching seemed always fall behind research and clinics as a priority. I saw scholarship in education as the best way to enhance the priority of teaching at Research I university. Thus, I wanted to study this field and bring pedagogical knowledge and evaluation skills to the higher education scientific community.

In my first year, I took an evaluation course which prompted me to conceptualize this study. It started, in part, as a way to evaluate the AAH certificate program in its effectiveness in preparing students. However, I also wanted to address the role of the Doctor of Veterinary Medicine (DVM) degree curriculum in students’ preparation since AAH training is mainly within the elective portion of their degree. I view the ultimate evaluators of a degree’s quality as being the degree-holder and their employer so it was important to me to capture both of these viewpoints in the study. Yet, I also acknowledge the limitations (especially in finances and time) of university degree programs, and thus seek the most efficient and effective solution to best meet the needs of all stakeholders. My previous research background made me more comfortable with quantitative research but I knew the value of personal stories through my work experience vying to keep soft money funding through the State. My doctoral education helped further expose me to the value of qualitative research and, as a pragmatic researcher, I am a believer that mixed methods studies offer the best of both worlds for complex evaluations such as this.
In total, I worked for the CVM for ten years (including seven and a half years full-time in AAH) before transferring to an Instructional Designer position serving all colleges at the University of Florida (where I have now worked for a year and a half). Over the years, I became friends with many veterinary students, graduate students, staff, and faculty at the CVM and throughout the small community of AAH. I am still friends with many of these people which has undeniably helped me to obtain data from many respondents. While I acknowledge these friendships may have kept some participants from being fully-forthcoming about some of their experiences, my perception was it garnered an easy, fast building of rapport with interviewees who I didn’t know beforehand and led to greater openness in the interviews overall.

Participants: Recent Graduates

The data from the recent graduate survey were used to select the alumni for interviews. To achieve maximal variation, one graduate working in each of the five fields were included, as were those with differing levels of overall satisfaction with their veterinary medical education, those graduating in different years, and those with and without an aquatic-focused ACZM residency training program at their alma mater. Additional possibilities for ensuring inclusion of diverse viewpoints were also considered, such as including respondents with varying participation in internships or residencies that were 50% or more aquatic-focused and including those who represented a range in percent time spent on AAH clinical and research job duties (see Table 3-1 for the characteristics of each interviewee). Sampling occurred until saturation had been reached (Fossey et al., 2002).
Table 3-1. Characteristics of the interviewees

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Grad. year</th>
<th>Overall satisfaction with DVM education</th>
<th>CVM offers an aquatic-focused ACZM residency</th>
<th>≥ 50% AAH internship/residency experience</th>
<th>AAH organization type</th>
<th>% clinical and research in AAH duties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stanley</td>
<td>2011</td>
<td>Extremely satisfied</td>
<td>No</td>
<td>Internship</td>
<td>Non-profit (aquarium)</td>
<td>Clinical: 90%+ Research: 6-10%</td>
</tr>
<tr>
<td>Beth</td>
<td>2012</td>
<td>Satisfied</td>
<td>Yes</td>
<td>Residency</td>
<td>University</td>
<td>Clinical: 0% Research: 61-89%</td>
</tr>
<tr>
<td>Jean</td>
<td>2012</td>
<td>Satisfied</td>
<td>Yes</td>
<td>Residency</td>
<td>University</td>
<td>Clinical: 61-89% Research: 21-39%</td>
</tr>
<tr>
<td>Jessie</td>
<td>2012</td>
<td>Satisfied</td>
<td>Yes</td>
<td>Internship</td>
<td>1°: Corporate 2°: Volunteer at non-profit (aquarium)</td>
<td>Clinical: 11-20% Research: 6-10%</td>
</tr>
<tr>
<td>Sally</td>
<td>2011</td>
<td>Extremely satisfied</td>
<td>No</td>
<td>Internship</td>
<td>1°: Government 2°: Non-profit</td>
<td>Clinical: 21-39% Research: 40-60%</td>
</tr>
<tr>
<td>Billy</td>
<td>2014</td>
<td>Somewhat satisfied</td>
<td>Yes</td>
<td>Neither</td>
<td>1°: Small Business 2°: Corporate (aquarium)</td>
<td>Clinical: 90%+ Research: 11-20%</td>
</tr>
</tbody>
</table>

Data Collection

Interview requests were sent through e-mail (see Appendix D). The interviews were conducted via video conference and the one hour (approximately) sessions were recorded and transcribed for analysis. One departure from this process was with the last interview. Billy’s interview recording was lost in a catastrophic hard drive failure before it could be transcribed. Therefore, field notes were relied upon for data analysis and
quotes from Billy are not represented in the results. As previously mentioned, a semi-structured interview guide was used (see Appendix E) to facilitate inquiry into explanations for the previously analyzed quantitative data. As such, many questions were tailored to specific responses on the survey instrument and inapplicable questions were skipped. Field notes documenting these decisions, as well as reflections by the interviewer after each session, were recorded.

Data Analysis

The interviews were transcribed and then summarized. Initial coding categories were then created from the summaries following the constant comparative method, as described by Harding (2013). A thematic analysis approach was used where multiple levels of coding schemes were formed. As new codes emerged, previously coded interview summaries were re-analyzed so as to accurately capture the frequency of each code. The preliminary results were presented to several participants for member-checking, all of whom agreed with the researcher interpretation of the findings.

Trustworthiness

Direct quotes were used so the participant’s voice is clear and readers have the opportunity to draw their own conclusions. Both directly delivering knowledge to stakeholders and facilitating self-discovery of value knowledge amongst stakeholders are goals of responsive evaluation (Abma & Stake, 2001). Additionally, thick descriptions can act as vicarious experiences resonating with stakeholders and impacting decision-making similar to how their own personal experiences guide practice (Abma & Stake, 2001). Results are presented showing triangulation of major findings. Additionally, meta-inferences were reviewed by several participants (including Billy since that recording was lost before transcription) for member-checking of conclusions.
Notes were also kept on the methodological decisions and reflections during Phase 3 to provide an auditable trail, as described by Dooley (2007) and Abma (2005). This serves as evidence of credibility, confirmability, and overall trustworthiness (Freeman, deMarrais, Preissle, Roulston, & St. Pierre, 2007).

Conclusion

Creswell and Plano Clark (2011) offered evaluation criteria of mixed methods studies as:

- collects both quantitative and qualitative data,
- employs persuasive and rigorous procedures in the methods of data collection and analysis
- integrates or “mixes” (merges, embeds, or connects) the two sources of data so that their combined use provides a better understanding of the research problem than one source or the other,
- includes the use of a mixed methods research design and integrates all features of the study consistent with the design,
- frames the study within philosophical assumptions, and
- conveys the research using terms that are consistent with those being used in the mixed methods field today. (p. 267-268)

This research design reflects a strategy to meet these criteria by presenting a philosophical overview, transparent framework for the mixed methods components, and acknowledgement of reliability and validity points of concern. Furthermore, and above all (as posited by Creswell and Plano Clark, 2011), the research question is presented with a conceptual framework showing it can best be addressed through the proposed use of both quantitative and qualitative methods, rather than either method on its own.

Summary

This study used novel, electronic instruments to survey recent veterinary graduates specializing in aquatic animal health and their employers. The employer data were collected quantitatively in Phase 1 and focused on job analysis, job market and
hiring characteristics, veterinary education areas needing improvement, and the job market outlook. The recent graduate data were collected sequentially beginning with quantitative research on their preparedness, career satisfaction, educational experiences, and areas needing improvement, as the focus of Phase 2. The quantitative data from each stakeholder group were compared, similarities and differences were recorded, and further investigation was conducted qualitatively. In Phase 3, the final phase, further detail on the quantitative findings were sought, including explanations for barriers to preparedness and specific features of a curriculum seen as successful or, conversely, associated with poor learning. The use of the mixed methods design is justified by the research questions and objectives. Triangulation of stakeholders’ perspectives on the curricula and outcomes is a key attribute of this study, as is documentation of divergent views.
CHAPTER 4
RESULTS

In this sequential mixed methods study, different stakeholder groups were surveyed as part of a responsive evaluation process investigating the components of the veterinary medical curriculum that best prepare students for entry-level careers in Aquatic Animal Health (AAH). Employers were surveyed first and were asked to help recruit respondents for Phase 2, the recent graduate survey. The results from these surveys are provided below. Additionally, not all values and perceptions could be captured through quantitative methods so interviews were conducted with recent graduates to help explain some of the findings, particularly discrepancies with employer values and perceptions. These insights and themes are also discussed herein.

Phase 1: Employer Survey Results

The 43-item novel survey instrument was sent to 94 employers working primarily or partially in AAH and representing government agencies, academia, small businesses (including private practice and independent contractors), corporations and non-profit organizations (including zoos and aquariums). The response rate overall was 72% (n = 68). The response rate was similar for both males (n = 39, 70%) and females (n = 29, 76%). However, because of the skip logic in the electronic survey instrument, the number of respondents per question was highly variable. Surprisingly, 32% (n = 21) responded they work for more than one organization in their career (see Table 4-1 for a breakdown of respondents by organization type). So, the primary employment organization was separated from the total in Table 4-1. Those who worked for a corporation (n = 12) or non-profit organization (n = 24) were asked if their organization
was a zoo or aquarium. Three people representing corporations said yes (25%) and 16 agreed amongst the non-profit respondents (67%).

Table 4-1. Employer response rate by organization type (question response rate = 70%)

<table>
<thead>
<tr>
<th>Organization Type</th>
<th>Government Agencies</th>
<th>Academia</th>
<th>Small Businesses</th>
<th>Corporations</th>
<th>Non-Profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employers contacted, n = 94</td>
<td>21</td>
<td>16</td>
<td>21</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>Responses, n = 66, organization total = 97</td>
<td>17</td>
<td>20</td>
<td>24</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>Primary organization (response rate)</td>
<td>14 (21%)</td>
<td>12 (18%)</td>
<td>15 (23%)</td>
<td>10 (15%)</td>
<td>15 (23%)</td>
</tr>
</tbody>
</table>

It should be acknowledged, respondents could not select that they held multiple positions within the same organization type (for example, working for two different non-profits), which is a limitation of this study. However, this was not included in the comments field for any respondent as being an issue. One respondent did note her responses were “biased depending on which lens I was using so had to split it down the middle (work in two worlds with very different perspectives).” Therefore, some views may not have been fully represented as people with multiple roles struggled to find one answer to represent both jobs or favored their primary position.

**Demographics and Job Analysis**

Respondents have been working in the AAH field for a mean of 19.5 years (range: 3 – 30+ years). It should be noted that since the maximum was 30 years and eight people responded to this maximum, the mean is likely underestimated. A great majority of the respondents were from the U.S. (n = 55, 83%). A few were from Canada.
(n = 7, 11%) and elsewhere (n = 4, 6%). Additionally, the vast majority of employers were veterinarians themselves (n = 57, 88%). Half of the respondents have graduates degrees (13 have a master’s degree, 1 has two master’s degrees, 12 have a PhD, and 6 have both). Of the veterinarian employers, 30% have diplomate status (11 with the American College of Zoological Medicine and 6 elsewhere). Veterinarians were also asked to estimate their time spent on clinical and research job duties in AAH (see Figure 4-1) and their percentage of time spent with different aquatic taxa (Figure 4-2). Both of these showed high levels of diversity amongst respondents. Some veterinarian employers replied they spent their time in AAH exclusively working on one taxon (six specified fish, two specified aquatic mammals, and one person specified aquatic birds). Most responded with a mix of time spent between taxa, with as little as zero for a group (this was the case for 24 of the 55 veterinarian employers when asked about aquatic invertebrates as well as 23 of the respondents for aquatic birds, 20 people for aquatic reptiles/amphibians, 20 people for aquatic mammals, and just 6 of the respondents for fish) and a maximum of 90% of the time for aquatic reptiles/amphibians and 50% of the time for aquatic invertebrates (100% was the maximum for the other taxa as previously mentioned).

Veterinarian employers were asked about the importance of a variety subject areas to their position as well as to the job duties of a veterinarian they might supervise with less than three years of experience (see Figure 4-3). Since all items are often viewed as important, it was not surprising some respondents expressed frustration with having to rank one area over another. Therefore, minor place differences in the Figure 4-3 bump chart are probably not very meaningful. The two largest shifts are by three
places which would indicate at least some change in the importance value based on job position. The category of Environment shifted from fourth place amongst veterinarian employers’ self-importance down to seventh place for subordinates with less than three years of experience. Alternatively, Medicine and Surgery was viewed as more important for subordinates, shifting from sixth place up to third. This could be interpreted as the veterinarian employers viewing their role as more important for big-picture habitat issues while subordinates are more focused on individual cases. However, minor shifts in these middle ranked areas could have just exaggerated the effects on these two categories. There seems to be more consistency in the most and least important items. Diagnostics and Preventive medicine were first and second in importance for both types of positions while Research and Restraint were eighth and ninth, respectively.

![Figure 4-1. Percent time veterinarian employers spend on clinical (n = 54) and research (n = 53) job duties.](image)

Figure 4-1. Percent time veterinarian employers spend on clinical (n = 54) and research (n = 53) job duties.
Figure 4-2. Percent time, on average, veterinarian employers ($n = 55$) spend working with different aquatic taxa.

Figure 4-3. Veterinarian employers’ rankings of subject areas in order of importance to their position and compared to positions held by subordinates with less than three years of experience. Admin. = Administration
Preparedness of Recent Graduates

The majority of employers responded the average recent Doctor of Veterinary Medicine (DVM) graduate does not have the knowledge or experience needed in any of the aquatic taxon categories (mammals, fish, birds, invertebrates, reptiles, and amphibians) to meet their organization’s needs (Figure 4-4). The largest deficiency is in fish medicine (both fresh and saltwater species). Fish was also ranked first by employers as the taxon in which the most additional experience is needed by new graduates (within two years of graduation) in order to perform well (Figure 4-5). Likely due to the proportion of time spent with each taxon, mammals averaged as the second-most taxon where new graduates need more experience even though invertebrates and amphibians were the second and third highest, respectively, taxa for below needs.

Figure 4-4. Employers’ views on how the average new (within one year of graduation) veterinarian’s knowledge base and experience in varied aquatic taxa meets the needs of their organization (n = 59 except Fish, n = 61, and Invertebrates, n = 60).
Figure 4-5. Employers’ rankings of aquatic taxa where the most additional experience is needed to perform well in job duties.

The employers who responded with below needs were asked to further identify the types of training that would be needed. All of the options were chosen by some of the employers but the most selected item was more exposure to clinical cases (Figure 4-6). All employers were also asked about the ideal percentage of memorized aquatics knowledge new veterinarian hires (within two years of graduation) should be able to immediately recall for problem solving versus use of other resources to problem solve (for example, familiarity with accessing and critically evaluating publications or consulting with specialists). The average ratio was 42.1% memorization and 57.9% use of resources. However, the range was almost the full spectrum with 0 being the lowest for memorization and 20% the lowest for use of resources.

In addition to technical aspects like taxon knowledge and skills, employers were asked about non-technical skills. Figure 4-7 shows the importance ranking by employers of eleven different non-technical skills. Honesty/Integrity was most commonly ranked first (34% of the employers, n = 22). Other highly ranked items included Teamwork/Interpersonal skills, Motivation/Initiative, Work ethic, Communication skills,
and Analytical/Critical thinking skills. Dominating last place was Business skills, which was chosen last by 65% of employers ($n = 42$).

**Figure 4-6.** Types of training needed to better prepare new graduates who employers felt were below needs on average ($\Sigma =$ Total of all six taxa).

**Figure 4-7.** Employer importance ranking of non-technical skills ($M = 5$, $SD = 2.26$).
Employers were also asked to choose the top three non-technical skills commonly possessed by veterinarian employees and colleagues as well as the top three commonly need improvement (Figure 4-8). The most commonly possessed skills were Motivation/Initiative \((n = 38)\), Analytical/Critical thinking skills \((n = 32)\), and Honesty/Integrity \((n = 27)\). The most common non-technical skills needing improvement were Teamwork/Interpersonal skills \((n = 32)\), Communication skills \((n = 31)\), and Time management \((n = 28)\). Therefore, the second most important non-technical skill, Teamwork/Interpersonal skills, was also the one most needing improvement. Additionally, Communication skills was viewed as important, ranked fifth, yet was almost as often chosen as needing improvement.

Figure 4-8. Employers’ assessment of the most commonly possessed non-technical skills and those needing improvement.
Hiring Practices and Job Market

The majority of respondents had actively hired a veterinarian for an aquatic animal health position (including interns and residents) in the past five years ($n = 40$, 60%). Table 4-2 shows the number of hires by a singular employer. However, involvement in hiring could be as part of selection committee. In fact, only 12 employers responded they always serve as the primary decision maker. Another 12 responded they were always a part of a selection committee and 7 responded that their role varied. The rest ($n = 8$) were sometimes part of the decision-making process but not always. In total, about 89 hires were reported (see Table 4-3). However, it should be noted that given the timeframe, some of these hires could be the same person changing jobs. Additionally, not all of these hires were recent graduates, 28 of them (31%) had at least 5 years of work experience or had completed residency training. However, almost all of the recent graduate hires (95%) were for internship positions (see Table 4-3).

Table 4-2. Respondent involvement in hiring AAH veterinarians over the past five years

<table>
<thead>
<tr>
<th># of employers</th>
<th>1 hire</th>
<th>2-3 hires</th>
<th>4-6 hires</th>
<th>7-9 hires</th>
</tr>
</thead>
<tbody>
<tr>
<td># of employers</td>
<td>3</td>
<td>21</td>
<td>11</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 4-3. Experience level and quantity of AAH hires (the sub-set internship positions are in parentheses)

<table>
<thead>
<tr>
<th>Experience level</th>
<th># (internship)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand-new DVM graduate (within 3 months of graduation)</td>
<td>10+ (10+)</td>
</tr>
<tr>
<td>DVM with &lt;1 year of relevant work experience</td>
<td>10 (10)</td>
</tr>
<tr>
<td>DVM with 1 year of relevant work experience or a relevant internship</td>
<td>17+ (16)</td>
</tr>
<tr>
<td>DVM with 2 - 4 years of relevant work experience/internships</td>
<td>24+ (22)</td>
</tr>
<tr>
<td>Recently completed residency training and minimal other work experience</td>
<td>6</td>
</tr>
<tr>
<td>DVM with 5 - 9 years of relevant work experience/internships</td>
<td>12</td>
</tr>
<tr>
<td>Diplomate and work experience OR over 10 years of relevant work experience</td>
<td>10</td>
</tr>
</tbody>
</table>
Employers were asked to select the work experiences or internships they deemed relevant to the AAH positions for which they hire veterinarians (Table 4-4). Interestingly, not all of the 39 respondents agreed that a primarily aquatic specific work experience or internship would be relevant. Perhaps this is because those working exclusively with fish, for example, do not view experience with other taxa as relevant. However, on average, when hiring someone with less than three years’ experience, the desired percentage of prior experience was 42% fish, 32% mammal, 11% bird, 11% reptile/amphibian, and 4% invertebrate (Figure 4-9). Also noteworthy, small animal experiences were viewed as having relevancy to more employers than large animal.

Table 4-4. Employers views of experience type relevancy to AAH veterinarian positions (n = 39)

<table>
<thead>
<tr>
<th>Experience type</th>
<th>% agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primarily aquatic specific work experiences/internships</td>
<td>72</td>
</tr>
<tr>
<td>Primarily exotic/zoological medicine work experiences/internships</td>
<td>51</td>
</tr>
<tr>
<td>Small animal medicine or surgery work experiences/internships</td>
<td>38</td>
</tr>
<tr>
<td>Any formal veterinary internship training program</td>
<td>31</td>
</tr>
<tr>
<td>Large animal medicine or surgery work experiences/internships</td>
<td>23</td>
</tr>
</tbody>
</table>

To further investigate more favorable internship and work experiences, employers were asked to rank applicants that are most likely to be hired for a junior clinical position at their organization based on different one-year experiences. The applicant with a year of experience as zoological medicine intern at a university was overall ranked first ($M = 1.68$, $SD = 1.00$). Next was the internal medicine intern applicant ($M = 2.69$, $SD = 1.00$), also at a university, and close behind an applicant who worked at a small animal private practice as a clinician ($M = 2.71$, $SD = 1.06$). Last was an internal medicine/surgery intern who worked at a small animal corporate private practice ($M = 2.92$, $SD = 1.00$). Subsequently, employers were asked to choose
between three interns with advanced beginner knowledge in aquatic animal medicine. Narrowly beating one of the others, with 44% \( (n = 28) \) of the employers’ selection, was the intern who has additional abilities to effectively use educational resources (critically reviews scientific literature, more familiar with aquatic medicine resources, seeks specialist advice, etc.). Almost as many employers \( (42\%, \ n = 27) \) choose the intern with additional clinical competencies in aquatic animal health from one year of work experience. The remainder \( (14\%, \ n = 9) \) choose the intern with additional clinical competencies in small animal medicine from one year of work experience.

![Figure 4-9. The average response by employers for the desired experience ratio with different aquatic taxa new hire veterinarians should have \( (n = 67) \).](image)

When asked about the job market for AAH veterinarians over the next ten years in the U.S., employers projected each field would mostly maintain their current conditions (Figure 4-10). Rehabilitation facilities \( (M = 2.70 \text{ on the five point scale}, \ SD = 0.83) \) and academia \( (M = 2.88, \ SD = 0.85) \) were viewed as having a greater likelihood for a slight decrease in hiring. Whereas, aquaculture was viewed as the most stable job market \( (M = 3.4, \ SD = 0.89) \). In all fields though, very few people \( \text{max} = 4 \) anticipated significant hiring decreases or increases in any one area.
Figure 4-10. Employers’ ten-year outlook of the veterinarian new hire job market in AAH in the U.S. (except the International category).
Phase 2: Recent Graduate Survey Results

Employers were asked to help recruit recent graduate (RG) participants so the exact number of recent graduates who received the survey instrument is unknown (since employers could have forwarded the link to the instrument instead of providing contact information to the researcher). As a reminder, employers were told recent graduates included those who graduated between 2008 and 2014 from an AVMA-accredited school. Since employers were not expected to know this undoubtedly, the first questions on the survey instrument screened for these demographics (see next section). Based on the contact information received, it is only known that at least 29 recent graduates received the 36-item novel survey instrument and 86% ($n = 25$) of them responded. Additionally, it is known at least 18 respondents were female and 5 were male, leaving only 2 unknown. Thus, female participation (between 72-80% of respondents) was near the recent graduate average of 78% (Dall et al., 2013). Table 4-5 shows the breakdown recent graduates by organization type, again quite a few respondents (24%) worked for multiple organizations. However, the category breakdown was not as evenly distributed as the employers, with almost half working primarily for non-profits. The majority of non-profits ($n = 10, 67\%$) and corporations ($n = 2, 67\%$) that hired recent graduates were zoos or aquariums.

<table>
<thead>
<tr>
<th>Table 4-5. Recent graduate response rate by organization type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responses, $n = 25$, organization total = 35</strong></td>
</tr>
<tr>
<td>Government Agencies</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td><strong>Primary organization (response rate)</strong></td>
</tr>
<tr>
<td>3 (12%)</td>
</tr>
</tbody>
</table>
Demographics and Job Analysis

Of the recent DVM graduates, seven have master’s degrees, at least three are PhD candidates, and two are Diplomates of the American College of Veterinary Pathologists. They graduated from a variety of veterinary schools but the most frequent responses were the University of Florida and the University of California (see Table 4-6). Additionally, Table 4-7 shows the number of respondents who graduated in each year between 2008 and 2014. All of the respondents \((n = 24)\) were at least somewhat satisfied \((n = 4)\) with their veterinary medical education. Twelve were satisfied and eight were extremely satisfied resulting in a mean of 6.17 on the seven point scale \((SD = 0.70)\).

<table>
<thead>
<tr>
<th>Alma mater</th>
<th># of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Florida</td>
<td>7</td>
</tr>
<tr>
<td>University of California</td>
<td>5</td>
</tr>
<tr>
<td>North Carolina State University</td>
<td>3</td>
</tr>
<tr>
<td>Texas A&amp;M University</td>
<td>2</td>
</tr>
<tr>
<td>Iowa State University</td>
<td>1</td>
</tr>
<tr>
<td>Kansas State University</td>
<td>1</td>
</tr>
<tr>
<td>Michigan State University</td>
<td>1</td>
</tr>
<tr>
<td>The Ohio State University</td>
<td>1</td>
</tr>
<tr>
<td>Tufts University</td>
<td>1</td>
</tr>
<tr>
<td>University of Missouri</td>
<td>1</td>
</tr>
<tr>
<td>Virginia Maryland CVM</td>
<td>1</td>
</tr>
<tr>
<td>Western University of Health Sciences</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th># of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>3</td>
</tr>
<tr>
<td>2009</td>
<td>2</td>
</tr>
<tr>
<td>2010</td>
<td>3</td>
</tr>
<tr>
<td>2011</td>
<td>4</td>
</tr>
<tr>
<td>2012</td>
<td>7</td>
</tr>
<tr>
<td>2013</td>
<td>2</td>
</tr>
<tr>
<td>2014</td>
<td>4</td>
</tr>
</tbody>
</table>
Table 4-8 shows the types of AAH-specific or general Zoological Medicine internships and residencies respondents have completed. All of the respondents ($n = 19$) have completed at least one internship or residency. The other six survey respondents did not select “none of the above” so it is unknown if they truly have not completed one of these experiences or if they just skipped this question. Of those who responded, six people completed two of the experiences listed in Table 4-8.

<table>
<thead>
<tr>
<th>Experience Type</th>
<th># of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAH Internship</td>
<td>15</td>
</tr>
<tr>
<td>AAH Residency</td>
<td>1</td>
</tr>
<tr>
<td>Non-university-based Zoological Medicine Internship</td>
<td>3</td>
</tr>
<tr>
<td>University-based Zoological Medicine Internship</td>
<td>3</td>
</tr>
<tr>
<td>Zoological Medicine Residency</td>
<td>3</td>
</tr>
</tbody>
</table>

Like the employers, recent graduates were varied in their current time spent on clinical and research job duties in AAH (see Figure 4-11). One striking difference, as seen in Figure 4-12, is 24% ($n = 6$) of the recent graduates spend 90% or more of their time on clinical job duties compared to only 7% ($n = 4$) of employers. Additionally, 5% more recent graduates than employers responded they spend 61 - 89% of their time on clinical job duties. So, there is a total of 22% more recent graduates spending 61 – 90+% of their time on clinical job duties.

Another area of investigation was the importance of different subject areas to the first positions held by recent graduates. The means for the importance level assessed by employers and recent graduates are presented in Figure 4-13. Since everything is viewed as important, a total mean line is presented as a way of identifying the top items. In addition, Figure 4-14 shows the ranked responses (based on these means) by recent graduates compared to the employer data (originally presented in Figure 4-3). Minor
shifts in rank are not likely to be very meaningful because of the overall importance of all items but two areas do appear to be unusually inflated. The category of Anatomy, Taxonomy, and Physiology was highly rated by recent graduates (second) whereas employers gave it a mid-level of importance for both themselves and their expectations for recent graduate positions. Additionally, Restraint, which was rated last by employers, was rated as mid-level importance (sixth) by recent graduates.

Figure 4-11. Percent time recent graduates \( (n = 25) \) spend on clinical and research job duties.

Figure 4-12. Percent time employers (clinical: \( n = 54 \), research: \( n = 53 \)) and recent graduates \( (n = 25) \) spend on clinical and research job duties.
Figure 4-13. Mean comparison of the importance of different subject areas to employers and recent graduates (Comm. = Communication; Educ. = Education; Admin. = Administration).
Figure 4-14. Veterinarian employers’ rankings of subject areas in order of importance to their position compared to positions held by subordinates with less than three years of experience (as presented in Figure 4-3) compared to the self-rankings of recent graduates (Admin. = Administration).
Preparedness of Recent Graduates

Recent graduates were asked how many lecture-based courses they took in veterinary school were 25% or more focused on AAH. Responses (n = 22) ranged from zero to twelve classes with a mean of 3.36 (SD = 3.08). On average, respondents (n = 23) participated in 79% of the AAH elective opportunities offered by their university. Sixty percent of recent graduates (n = 15) participated in at least one aquatic short course as a veterinary student (see Table 4-9). Ten people participated in at least two courses with the maximum response being participation in five courses by a single person. None of the respondents enrolled in one of these courses after graduation.

Table 4-9. Recent graduates participation in aquatic short courses

<table>
<thead>
<tr>
<th>Course Name</th>
<th># of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>AQUAMED</td>
<td>0</td>
</tr>
<tr>
<td>AQUAVET I</td>
<td>5</td>
</tr>
<tr>
<td>AQUAVET II</td>
<td>5</td>
</tr>
<tr>
<td>AQUAVET III</td>
<td>0</td>
</tr>
<tr>
<td>Diseases of Warmwater Fish</td>
<td>8</td>
</tr>
<tr>
<td>Envirovet</td>
<td>3</td>
</tr>
<tr>
<td>Marvet</td>
<td>2</td>
</tr>
<tr>
<td>SeaVet</td>
<td>8</td>
</tr>
</tbody>
</table>

Recent graduates completed at least one AAH externship (defined as at least 50% or more of their time per week working with aquatic species). Of the 22 respondents, the minimum was a singular two-week AAH externship and the maximum was five different externships totaling 20 weeks. The average response was 2.59 (SD = 1.30) externships for 9.95 weeks (SD = 5.50).

Overall, the majority recent graduates felt their knowledge base and experience with all taxa met or exceeded the needs of their first position (Figure 4-15). The largest group was for met needs in the taxa of mammals (n = 18, 82%), fish (n = 14, 74%),
birds ($n = 14, 61\%$), and reptiles ($n = 11, 48\%$). Below needs was only chosen more frequently than the other categories in the taxa of invertebrates ($n = 8, 47\%$) and amphibians ($n = 9, 47\%$). Unlike the employers, a few recent graduates also responded their knowledge base and experience exceeded the needs of their first position, still this was always the least frequent response (Figure 4-16).

**Figure 4-15.** Recent graduates' views on how their knowledge base and experience in varied aquatic taxa met the needs of their first position ($n = 23$).

**Aquatic Taxon**

**Figure 4-16.** The percentage of employers ($n = 59$ except for Fish, $n = 61$, and Invertebrates, $n = 60$) who feel the average new (within one year of
graduation) veterinarian’s knowledge base and experience in varied aquatic taxa meets the needs of their organization compared to recent graduates’ ($n = 23$) views of their own ability to meet the needs of their first position.

Recent graduates who responded with below needs in any taxon were asked to further identify the types of training they needed for all taxa. All of the options were chosen by some of the recent graduates but the most selected items were more coursework/background knowledge and more exposure to clinical cases (Figure 4-17). More knowledge and experience was seen as needed for both freshwater and marine species whenever a respondent selected below needs.

Surprisingly, both employers and recent graduates gave near identical results when asked about the ideal percentage of memorized aquatics knowledge new veterinarian hires (within two years of graduation) should be able to immediately recall for problem solving. Recent graduates were slightly higher than employers (less than 1% difference) with an average ratio of 42.5% memorization and 58.5% use of
resources. Again the ranges varied greatly with 10% being the least amount selected as necessary to memorize and 20% the lowest for use of resources.

Again, since everything is viewed as important, rankings (based on mean importance levels) were used to compare data on non-technical skills. Figure 4-18 shows the stability of the lower important non-technical skills in employers’ and recent graduates’ rankings. However, on average, Work ethic was most important to recent graduates, which caused Honesty/Integrity (employers’ most important skill), Teamwork/Interpersonal skills, and Motivation/Initiative to all shift down. Additionally, recent graduates felt their non-technical skills either met or exceeded the needs of their first position (Figure 4-19). The sole exception to this was for Business Savvy which was self-assessed as below needs by the same number of recent graduates who felt they met or exceeded the business skill needs or their first position. There was also five respondents who felt Business Savvy skills were not applicable to their first position.

Figure 4-18. Comparison of the importance of non-technical skills to employers and recent graduates.
Figure 4-19. Recent graduates’ (n = 21) views on how their non-technical skills met the needs of their first position.
Career Satisfaction and Job Performance

Overall, recent graduates were satisfied with their jobs (Table 4-10). Only one person expressed dissatisfaction (somewhat) and two people were neutral. Yet, three people responded they would be unlikely or very unlikely to obtain their veterinary degree if they could do it all over again (Table 4-11). All but one recent graduate felt at least some likelihood that they would still want to work in the field of AAH and the majority responded they were very likely to again pursue both their DVM and a career in AAH (Table 4-11). Since job satisfaction is also linked to performance, recent graduates were also asked about raises and promotions. Only five recent graduates (23%) have ever received a merit-based raise or promotion (see Figure 4-20), all of whom graduated in 2011 or earlier. Four of the respondents earned both a raise and a promotion once, while the fifth person earned two promotions but has never received a merit-based raise.

<table>
<thead>
<tr>
<th>Satisfaction Level</th>
<th># of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely Dissatisfied</td>
<td>0</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>0</td>
</tr>
<tr>
<td>Somewhat Dissatisfied</td>
<td>1</td>
</tr>
<tr>
<td>Neutral</td>
<td>2</td>
</tr>
<tr>
<td>Somewhat Satisfied</td>
<td>3</td>
</tr>
<tr>
<td>Satisfied</td>
<td>9</td>
</tr>
<tr>
<td>Extremely Satisfied</td>
<td>9</td>
</tr>
</tbody>
</table>

Table 4-10. Job satisfaction levels of recent graduates ($n = 24$, $M = 5.96$, $SD = 1.12$)
Table 4-11. Recent graduates’ likelihood of following the same career path if they could do it all over again ($n = 22$, $M_{DVM} = 5.86$, $SD_{DVM} = 1.86$, $M_{AAH} = 6.32$, $SD_{AAH} = 0.95$)

<table>
<thead>
<tr>
<th></th>
<th>Very Unlikely</th>
<th>Unlikely</th>
<th>Somewhat Unlikely</th>
<th>Undecided</th>
<th>Somewhat Likely</th>
<th>Likely</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtain DVM</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Pursue AAH career</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>13</td>
</tr>
</tbody>
</table>

Figure 4-20. The incidence of merit-based raises and promotions amongst recent graduates ($n = 22$).

Work Experience Values and Job Market

As part of the information gathered on employer hiring practices, various internship experiences were presented for value judgments. For comparison to the employers’ values, recent graduates were also asked to rank applicants with different work experiences. Recent graduates ($n = 18$) selected the same first choice candidate as employers, the applicant with a year of experience as zoological medicine intern at a university ($M = 1.44$, $SD = 0.86$). Next though was the employers' last choice, the internal medicine/surgery intern who worked at a small animal corporate private practice.
(M = 2.61, SD = 1.14). Then, the internal medicine intern applicant from a university (M = 2.94, SD = 0.87), and close behind, an applicant who worked at a small animal private practice as a clinician (M = 3.00, SD = 0.91). When asked to choose between three interns with advanced beginner knowledge in aquatic animal medicine, the recent graduates (n = 22) greatly diverged from the employers. The top choice, with 59% of respondents (n = 13), was the intern with additional clinical competencies in aquatic animal health from one year of work experience. Another sizable portion (n = 6, 27%) choose the intern with additional clinical competencies in small animal medicine from one year of work experience. Only 14% (n = 3) of the recent graduates choose the employers’ selection, the intern who has additional abilities to effectively use educational resources (critically reviews scientific literature, more familiar with aquatic medicine resources, seeks specialist advice, etc.).

When asked about the job market for AAH veterinarians over the next ten years in the U.S., recent graduates differed in their responses from the employers (Figures 4-21 and 4-22). Overall, they agreed with the employers’ projections that each field would mostly maintain their current conditions and very few identified a field as having a significant increase (max = 3) or decrease in hiring (max = 1). However, recent graduates viewed the newer field of One Health as having a slight increase in hiring over the next ten years (M = 3.91, SD = 0.61). Additionally, a larger percentage of recent graduates (91%, n = 20) than employers (63%, n = 30) viewed clinical aquarium medicine as being static or decreasing in hiring (M_{RGS} = 2.86, SD = 0.56). Thus, recent graduates view rehabilitation, academia, and international work as a more stable than clinical aquarium medicine, unlike employers.
Figure 4-21. Recent graduates' ten-year outlook of the veterinarian new hire job market in AAH in the U.S. (except the International category)
Figure 4-22. Mean comparison of the employers and recent graduates ten-year job market outlook (5 = significant increase in hiring, 1 = significant decrease in hiring).
Phase 3: Recent Graduate Interviews

The only commonality in the recent graduates’ veterinary education experiences was that each one completed at least one externship. As presented above, the number of facilities and the number of weeks at each was highly varied, as was the number of traditional classroom courses in AAH and participation in short courses (mix of lecture and labs). This variability was expected since AAH is a relatively small specialty where training is only available through electives. As such, the research design included interviews with recent graduates to gain further insight into commonalities in perceptions of and barriers to preparedness.

As shown in Table 3-1, at least one interview was conducted with a recent graduate respondent representing each of the five organization types. Additionally, half of the six interviews were conducted with people who responded they work for multiple organizations. During the interviews it was discovered that since completion of the survey three months ago, two of the respondents no longer work for multiple organizations. One made the decision to leave their secondary position to focus on their primary job. The other was in a unique, collaborative arrangement between two organizations but very recently, after several years of this relationship, one organization found funding to support her full-time for the same job duties. Thus, she has been formally separated from the second organization (seemingly amicably by all parties). In addition, the third person clarified their second position is in an unpaid volunteer capacity. These affiliation changes are noted in the interest of providing as fully accurate representations of the interviewees as possible but are not believed to impact the relevancy of their perspectives to other recent graduates. In actuality, these shifts in
secondary employment status and the occurrence of working part-time in an unpaid position are likely representative of other recent graduate survey respondents as well.

However, the interviewees are potentially biased in their views relating to research. Although seven recent graduates (28%) responded they spend 0% \( (n = 4) \) or only 1-5% \( (n = 3) \) of their time on research job duties, the minimum amongst interviewees was 6-10% research job duties \( (n = 2) \). Moreover, three of the interviewees had master’s degrees prior to entering veterinary school and two are currently in graduate degree programs (one of whom is also one of the three with a master’s degree). Thus, research experience is over-represented in this sample which may have impacted the dominant themes discussed herein.

Additionally, the range in graduation years (2008 – 2014) was not represented by the interviewees. The average graduation year was 2011 and two interviews represented this class. The other four graduated more recently. Thus, the experiences of older graduates were under-represented. However, with newer graduates it is more likely that their experiences will be more accurately recalled, and thus provide greater validity. As it was, a few times interviewees acknowledged they did not have a vivid memory of the details of their experiences. For example, when asked about changes that should be made to AAH lectures, a 2012 graduate stated, “I think if I were a little bit closer to the time I might be able to kind of nitpick on a few things like lecture structure, things like that, but I mean overall, I think it was pretty good.” Likewise, a 2011 graduate acknowledged how lectures from different courses seemed to blend together in the curriculum by making remarks such as, “I can’t even remember what the course was called,” “I don’t remember how many classes we had,” and “there was probably, like,
one elective that [focused on zoological medicine]." Additionally, since many schools are working on curriculum changes to meet the North American Veterinary Medical Education Consortium recommendations, these findings will be more applicable than those with older graduates who have not experienced the latest improvements. Therefore, this incongruity is believed to be of benefit to the study overall.

Also of note, five of the six interviewees graduated from the three universities that were the most common amongst respondents (60% graduated from the University of Florida, University of California, or North Carolina State University). These schools are well-known for their zoological medicine programs (two in AAH specifically). Thus, the interviewees likely had more zoological medicine elective course options than other respondents. Again, this is viewed as only enhancing the study as recommendations for improvements to strong programs can only help to guide effective development at other institutions. In addition, the interviewees received very little training, if any, during veterinary school from a university outside of their alma mater. One interviewee participated in a one-week short course that was not coordinated by her university and involved a mixture of lecturers from various universities and industry. More significantly, one person completed a two-week externship at another CVM as one of her electives. Beyond these experiences, the only exposure the interviewees had to AAH educational experiences at other universities came from academic internships and residencies after graduation.

The data analysis codes (second-level only) and resulting thematic categories are summarized in Table 4-12 and expanded upon here after. Since statements within an interview often used the same code multiple times, Table 4-12 only reflects the first
time a code was used per transcript. Thus, if all interviewees discussed the same topic, a six is shown in the table.

Table 4-12. Summary of the themes and second-level codes identified during the interview data analysis

<table>
<thead>
<tr>
<th>Thematic Category</th>
<th>Second-Level Code</th>
<th># of Interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active learning and teaching best practices</td>
<td>Hands-on</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Real world experiences</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Labs</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Case-based learning</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Attention</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Course notes</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Accountability</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Organization/SLOs/Depth</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Faculty pedagogic training</td>
<td>1</td>
</tr>
<tr>
<td>Maximizing elective opportunities</td>
<td>Negative track impact</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Limitations</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Initiative</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Research</td>
<td>6</td>
</tr>
<tr>
<td>Non-technical skills</td>
<td>Experiential learning</td>
<td>4</td>
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<tr>
<td></td>
<td>Communication</td>
<td>6</td>
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<tr>
<td></td>
<td>Teamwork</td>
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<tr>
<td></td>
<td>Time management</td>
<td>5</td>
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<tr>
<td></td>
<td>Curriculum integration</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Employer difference insights</td>
<td>5</td>
</tr>
<tr>
<td>Mentorship and collegial support</td>
<td>DVM mentors</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>First job mentors</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Pre-DVM mentoring</td>
<td>1</td>
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<tr>
<td></td>
<td>Informal settings</td>
<td>2</td>
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<tr>
<td></td>
<td>Colleague support</td>
<td>2</td>
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<tr>
<td></td>
<td>Internship quality</td>
<td>4</td>
</tr>
<tr>
<td>Expectations and career satisfaction</td>
<td>Organization type/location</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Job duties</td>
<td>1</td>
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<tr>
<td></td>
<td>Professional growth</td>
<td>1</td>
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<td></td>
<td>No unintended outcomes</td>
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<td></td>
<td>Steep learning curve</td>
<td>3</td>
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<td>Continuing education</td>
<td>Lifelong learning</td>
<td>4</td>
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<td></td>
<td>Conferences</td>
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<td></td>
<td>Online</td>
<td>2</td>
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<tr>
<td>Alternative careers and debt awareness</td>
<td>Back-up veterinary career</td>
<td>2</td>
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<tr>
<td></td>
<td>Other AAH careers</td>
<td>2</td>
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<tr>
<td></td>
<td>Debt</td>
<td>4</td>
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<td></td>
<td>Salary</td>
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</table>
Active Learning and Teaching Best Practices

A major reoccurring theme in the interviews was a preference for hands-on learning. “Hands-on” was a frequent term used in description of active learning in real-world contexts requiring higher-order thinking skills such as application of knowledge. These experiences were viewed as most valuable to their preparedness and rarely occurred in the traditional classroom (the exception being case-based learning). Instead, hands-on experiences happened in the form of externships, clerkships, research projects, necropsy labs, stranding responses, and the like. Jessie recalled, “we were also down the coast and doing necropsies on dolphins and all these types of things. That was huge. That’s stuff that I could never even learn how to do, or become comfortable with, if we didn’t take that time, if we didn’t drive three hours to the beach and do what we did.” Sally stressed the importance of hands-on learning in AAH outside of a veterinary teaching hospital because there’s less access to equipment in fieldwork settings. She explained, while you may read about the ideal situation in a book, in the field, you are forced to be more practical. So, you have to assess what is most important and learn how to improvise without access to every tool. Even in the classroom though, active learning was emphasized. Beth advised educators to “get students involved as much as possible” to stimulate learning.

Several times a learning style was referenced when discussing their preference for hands-on learning. For example, Jean stated, “… I learn better by doing than I do by watching or reading something in a book most of the time, so it didn’t necessarily fit my learning style, I would have appreciated, I guess, more hands-on opportunities as a student, but again with the politics it is difficult to set those up.” Here, Jean also acknowledges that these experiences are difficult to arrange. In this context, she was
speaking about politics with hands-on opportunities at outside facilities. Students, rightfully, have limitations placed on their interactions with patients but those boundaries have not always been respected by previous externs (or understood as the case may be) which has led to conflicts with husbandry staff and further restrictions. Billy had also experienced this and expressed that externship facilities can be limiting in both the clinical and research opportunities one can have there. He also wished he could be more involved at those facilities and desired better communication on the expectations of externs and the activities in which externs can and cannot participate.

Didactic experiences were still seen as important even though they are relied on too often. Jean stated she appreciated having clerkships in her junior year and then going back to the classroom for more didactic learning as a senior. It let her apply what she had learned thus far and get more out of the classroom experience the second time. Additionally, Jessie explained how lectures helped him make the most out of his lab time:

I definitely learned more in lab settings then I did in more lecture settings. I think the lecture setting was absolutely necessary to walk into the lab setting, to really know left from right and up from down. But, the pieces of education that stuck with me the most were the parts that were in the lab where we actually did things, and saw things, and felt things physically with our hands, and with our eyes, and our senses, than actually just listening to lectures. I think they complement each other well.

Beth also acknowledged preparation is an important component of the laboratory experience and added that instructors should also provide a brief orientation at the beginning of the lab. She also recommended that the instructor to student ratio in these settings should be, at minimum, 1:5 or 6 at this level of education so students can be sufficiently assessed and have ample opportunity to ask questions. She has seen situations where students incorrectly practiced a procedure and they could be teaching
others very soon based off of this experience, so it’s especially important students receive feedback on their performance. Furthermore, Billy noted he found the team lab experiences very valuable and thinks they should occur more frequently in the curriculum since they facilitate learning and teamwork/interpersonal skills.

Sally described traditional lecturing as being a style of teaching she’s comfortable with even though she struggles with the merit of the approach. She spent a day at a university where they use case-based active learning techniques and she decided while it was seemingly more effective, it was too extreme for her. She feels a combination of didactic and active learning is likely best.

Multiple people spoke of referring back to their notes from courses in veterinary school and desired additional reference information. One person specifically recommended educators provide resource information electronically in the form of a compact disk (CD). Billy explained that he frequently refers to the fish medicine one that he received and wished he had one for other topics as well. Sally stated she had to learn to take lecture notes on a laptop because it was required at her institution which was difficult for her but ultimately beneficial because electronic notes has aided her in being able to quickly reference that material after graduation. One interviewee attributed people’s short attention span as a main reason for the ineffectiveness of lecture and thus the need for accompanying reference material. Likewise, another person described learning fatigue at the end of the day so even the instructor’s attempt at active learning via breakout sessions were futile because he just turned to his partner and pretended to discuss the topic so they could appear engaged enough to get to go home. Yet, the
material itself was valued enough that he kept it, moved it, and has reviewed it since completing his internship.

Faking discussion with a partner also shows a lack of student accountability in that setting. Accountability was brought up directly by two other interviewees when discussing face-to-face versus online courses. While none of the interviewees have participated in any predominately-online courses, a few have had some experience (a component of a larger course). Having a dedicated class time with a live instructor made Beth feel accountable to attend unlike online experiences where she has trouble being motivated. Similarly, Billy stated accountability is just as important in the online classroom as the traditional. Elaborating on this, he stated the assessments should be challenging enough that he isn’t able to quickly search for the answer with Ctrl-f and the instructor/teaching assistants should still offer live discussion sessions to answer questions. The consensus was face-to-face is preferable. One person explained it’s because they’ll have access to the instructor to ask questions and because they get non-verbal communication too.

Another recommendation for improving the lecture experience was related to a specific class. Beth complained one of the short courses she took was poorly organized and lacked clear student learning objectives. For example, since each day focused on a taxon, for continuity, they should all start with anatomy then common diseases followed by exam techniques. Another interviewee from this university also mentioned the lectures lacked detail and references to recent literature which limited their usefulness.

Similarly, Billy expressed frustration with faculty’s lack of pedagogic training and poor use of technology in the classroom. He felt strongly there should be more
encouragement of continuing education amongst faculty that focused on teaching. He also shared he served on a technology committee as a student and grant money for bringing technology to the classroom went unused because faculty did not even apply for it.

Maximizing Elective Opportunities

All of the interviewees described different tracks for their DVM degree program: small animal, large animal, mixed, ecological medicine, zoological medicine, and no tracking (so effectively, mixed). They emphasized how they applied concepts from each of the traditional small and large animal curricula to zoological medicine wherever they could, but the more valued learning experiences were in their electives since that was directly relevant to their preparedness. For example, Billy shared that the herd health principles of large animal medicine are very applicable to fish health management. Additionally, Stanley explained that she chose to take small animal ophthalmology because marine mammals have very bad eye issues whereas large animal anesthesia “can be very tricky” so that paralleled better to anesthesia in zoological medicine.

Billy felt the emphasis on small and large animal medicine in his curriculum and the lack of a zoological medicine or “build your own major” option was detrimental to his preparedness. With many professors, he felt very unsupported in his dedication to an AAH career path. Billy spoke of one clinician who was very vocal about how Billy would not be able to make a living as an AAH veterinarian and openly attempted to fail him in a small animal clerkship, just so Billy would have to take it again and spend more time honing his small animal medicine skills, because the clinician believed Billy would inevitably resign to practicing in that area. While the fundamentals of veterinary medicine can be universally applied across species, and he appreciated his strong
education in them, he felt the emphasis on small and large animals overwhelmed in the curriculum.

Beth noted she felt restricted in her elective coursework because you were considered either a fish person or a mammal person, so she wasn’t equally prepared in marine mammal medicine because she was viewed as a fish person. She explained, “Not that it was exclusive or anything, but it just seemed like if you went down one path you couldn’t really go the other or you got less of an education in the other side of things. I feel like the balance wasn’t equal.” In addition, Jean noted in trying to cover so much material within your electives, you lose out on repetition of the information, which is an important part of learning that she benefited from in small animal medicine.

Similarly, Stanley also struggled to get all of the types of elective experiences she wanted into her degree plan, She explained,

One thing that was a little difficult, and this is probably the same at all the universities, is that the way that you set up your electives, you can only do so many courses off-campus. So technically I could only do two off-campus. However, if you classify them other than an externship, say a Special Problems in Public Health, then you can go off-campus again. So, I had to get creative in order to go off-campus to all the places that I wanted to go, which was something I had to come up with on my own. It was not something that was advertised to me by my university.

Stanley also stated her clerkship and externship schedule was set-up so far in advance (6-9 months ahead) that it was difficult to plan externship experiences at facilities because the facilities weren’t planning that far in advance.

**Initiative.** One of the main pieces of advice from the interviewees was that students interested in an AAH career need take initiative in finding elective and extracurricular opportunities to learn. For example, Stanley said, as a zoo club board member, she approached a pathology resident and they worked together to create a
weekend workshop covering sea turtles. Sally also spoke about having to create some of her opportunities. She had an offer to work in another country on a marine mammal project (from a contact from her master’s experience), so she completed paperwork at her university to get it approved as an externship for elective credit.

Additionally, Stanley warned you can’t just rely on the opportunities the university publicizes because that information can often be out-of-date and more opportunities are usually out there. Sally emphasized you can’t “wait for it to fall in your lap” and you might have to step outside of your comfort zone to make these opportunities for yourself. However, she also cautioned against being too pushy in your requests to professionals. Beth also spoke about investigating other opportunities to enhance her training. She recommended the fish and wildlife departments in each state as an underutilized training source. Her experience with them was one of her few exposures to aquatic bird health issues. She added, that type of unique experience was great “but sometimes you don’t know what you don’t know,” so she would also encourage professionals to better promote these opportunities within veterinary schools.

Furthermore, Stanley noted there are different approaches to participating in externship experiences, and pros and cons to each, and you have to decide which one is best for you. She explained how she went to two longer externships so she could build a relationship with the staff and ultimately, be trusted to do more there. However, another approach is to schedule multiple, shorter externships at different facilities so you can experience more case variety as well as the different methods for approaching a case. Jessie also noted how being exposed to different clinician styles helped him identify what would work best for him.
Research. Another common activity as an elective was participation in research projects. As previously mentioned, three of the interviewees had master’s degrees prior to entering veterinary school and they credited that experience as one of the primary factors of their career preparation. Additionally, all three of the other interviewees stated they spent a significant amount of time working on research projects for elective credit and it provided a strong foundation for the job duties of their first position.

One interviewee explained that she spent a summer during veterinary school at an external facility working on a research project, so when she started her internship there after graduation she could transition directly into the veterinarian role instead of a trainee role because she knew the people and “how the facility operated.” She later added,

> It’s your mentors that are ultimately going to get you your jobs and you should stay in good contact with them. If you are doing a research project with them, then you should follow-up on it, finish it, do a good job, publish it if you can. There seems to be a big movement toward being published and publishing more. Research is a really big thing in aquatics and zoo too. So trying to get tied into that professionally, I think is a really good way to grow.

Thus, research provides an opportunity to make networking connections for job placement and makes you a more desirable applicant.

Jessie stated the elective research project experience he worked on over two summers in veterinary school was integral to his preparation for his first internship. Additionally, if he had not been exposed to research in veterinary school, he likely would have felt unqualified for a zoological medicine internship. Without elective research exposure, he postulated his reaction would be, “maybe I’m not really cut out for this type of position, or maybe for this field in general if that’s what it takes to get into the entry portion,” because DVM students don’t typically receive research training.
Conducting research studies and analyzing the research that is continually published in journals was also seen as an important component of the profession. Jessie explained it is important to contribute to the field through studying what has been done and working towards advancement of knowledge. He explained, “[I]n aquatic animal medicine where so much is unknown and the field is changing constantly,” you have to, minimally, be able to stay updated with the latest research, which means: be able to read journal articles, pick out what is important. Being able to determine ‘Does this study seem like it makes sense? Is this something I am going to go with and now I am going to give this animal this dose or should I be a little bit more critical?’ Being able to answer those questions and go through that process and use that to continue to learn as you’re in the field. I think that is important.

Jean echoed his feelings about the ever-growing body of knowledge and added that even if you are not the one conducting research directly, it is still important because as a veterinarian you will likely be involved in some capacity:

I think in the aquatic and zoological field being involved in research is very important. You may not be the primary person on that project, performing all the laboratory analysis, but there are a lot of times where you’re contacted by other PhD programs/students/researchers that want to utilize the species that you have contact with. So you might be that go-to person and later on, I’m assuming in my career, I’m going to have to evaluate private proposals- say, ‘yes, this is doable, feasible’ or I have to say ‘no, this is not something that our facility wants to support’ or ‘it’s not feasible, these procedures may be too invasive’. I have to make those decisions going forward, whether or not I’m the primary person. I think it’s just the nature of our field that we’re still learning so much about the species we have in captivity and in wildlife that research is always going to be a part of the clinical veterinarian’s career.

Jean also noted how her summer research project was just the execution of the research study and so she started her residency without adequate knowledge of initial research design and feasibility (in time, permitting, materials, and funding). So, she recommended having students be more involved in project design elements. Similarly,
Sally spoke of the merits of her master’s degree and how completing a project from start to finish better prepared her for her career than the pieces of research studies that she assisted with in veterinary school. One of her current coworkers, who is not a veterinarian, admitted he did not expect her to be able to write but was pleasantly surprised by how strong her scientific writing skills were and she attributes that ability to her master’s degree experience. Additionally, she stated going through a veterinary training program results in a lot of similar, high quality graduates, so her research experience is one of the few things that helped her stand out from her peers in the job market. Sally also added that having gone through a master’s degree program first and thinking of herself as a scientist with a DVM not a veterinarian with a master’s degree has greatly impacted her success in her AAH career. Biologists are more willing to work with her because she has an established relationship in the field and trust with them whereas, typically, veterinarians are viewed as egotistical and too difficult to collaborate with on research studies.

Non-Technical Training

**Informal training.** While the quantitative survey instrument covered details about how taxa should be further covered in the curriculum, non-technical training experiences were explored in the interviews. Everyone focused on communication training and it was just as frequently discussed as a skill developed through the informal context of experiential learning as it was the topic of formal training via an activity such as role-playing or dedicated classes. The informal experiences in which communication skills were developed included group projects and presentations in the classroom, but mostly interviewees discussed how clinic rotations improved their communication skills. Working on clinic rotations with real patients and clients allowed them to hone their
communication techniques through trial and error. Jessie discussed how he emulated the clinicians’ methods of interacting with clients to figure out what worked best for him. Beth shared she dreaded presenting on clinics but those experiences helped her to process constructive criticism and improve. Half of the interviewees mentioned that these same clinic rotation experiences also helped build teamwork/interpersonal skills and time management skills. Additionally, several people discussed how the experience of being in a cohort developed their interpersonal skills. In that small environment, you learn “how to deal with difficult people,” and Beth added in jest, “including yourself.”

Beth also felt her non-traditional education experiences during this time were of great value to her career preparation. However, she stated these AAH training activities were not supported by all faculty if it meant missing class to attend them instead. She felt strongly having to miss some of these activities was detrimental to her preparation because, as she explained, “the people that I have met at some of the conferences that I have gone to, and some of the experience that I have had, have really progressed me in the field, potentially more than sitting in a classroom listening to a lecture ‘cause that stuff you can always read later and you can always ask questions, find it yourself if need be.”

**Time management.** When interviewees spoke about developing time management skills, they all stated it has improved over time with more experience. As Jean noted, “I walked in with an adequate skillset for time management beforehand just with juggling multiple classes and the clinical responsibilities of vet school, but definitely something I improved upon in my internship.” The high caseload forced her to “keep things short and sweet with clients.” Sally felt she struggles with it, like most
veterinarians, because you cannot be effective if you strive for perfection in everything. She explained,

veterinarians are the sort of people that are generally pretty meticulous about detail and don’t like to let it go and when you get out in the real world, at least in my real world version, it’s all about knowing when to say ‘okay, this is good enough for now.’ And I would rather spend one hour doing a really good job versus six hours doing a meticulous job when that extra five hours really didn’t benefit the quality of what I needed to do. That’s an exaggerated example, but I do think that it’s something that I am still learning every day, is managing time.

Time management discussions also included work-life balance issues. Jean stated her internship had scheduled time off of one to four days, depending on the rotation, so it allowed for a healthy lifestyle which she prioritized. Once she transitioned to her residency she had to manage it herself and she struggled at first:

So I learned that I had to make time for myself to just be happy. Because if I didn’t, I just worked all the time. … The residency is way more work than compared to an internship, just with all the research and reading and studying and clinical obligations. You’re always behind on something, I’ve learned. By the end of the day, I need to take time for myself or else I’m not going to survive.

The other resident, Beth, also expressed that she prioritized time for herself, outside of her residency. She explained, “I want to make sure that I am doing things outside of [the residency] because this isn’t my life. It’s something that I enjoy doing, but it’s not something that I wanna be doing 24/7, so taking outside opportunities to do something completely different is super important to me.” Beth added, “I don’t think it diminished my learning experience and I actually think it enhanced it, because I got that down-time to recharge and think about things I want to do in the future, and it gives you a step away from whatever research you are working on so when you come back, you have a new perspective on it.” Sally described her balance as living in a vacation destination where she can hike and enjoy nature but felt everyone needs to find their own way to

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deal with the high demands. One interviewee described a benefit of specializing in AAH pathology as being able to take time-off easily because you don’t have patients dependent on you, and that was an important career path consideration. Yet, this emphasis on taking time off was not true for all interviewees. Billy noted he’s been working 15-hour days for the past month to successfully run his small business. Still, he enthusiastically spoke of his research and other projects he has been spending time on, which are separate from his main revenue activities.

**Curriculum integration.** Only one person described formal non-technical training as being integrated into the curriculum in short classes throughout the first three years of veterinary school. The goal seemed to focus on improving interactions with clients as empathy was emphasized. Even with this substantial training, this person remarked, “I think that the skills outside of anything clinical are the ones that are probably less developed while you’re in vet school and the ones I need more often not.” She has to translate her research and the conservation needs of the species to a form that is understandable by the public. So, she elaborated, communication is very important and the central component of her job is with people. As she described, “really most of what I do day-to-day has everything to do with people and nothing to do with animals.”

**Need for advanced role-playing scenarios.** Three others described shorter courses (one to a few weeks) on client interaction skills and one also discussed a business skills course. Role playing was a common activity described but they were often basic scenarios not situations that require higher level communication skills. As Jean described,
So you have these mock situations which did help because you have a one-on-one critique of the way you said these things were good or these things you can improve on. I think you got videotaped as well with an actual client and you sat down and reviewed it, was a part of that scenario. Which was great. Most of those cases however are wellness exams or it’s a long-term chronic case, it’s very different than an emergency situation when you have an animal that just coded and you’re starting CPR and you have to go talk to the owners and relay that information and discuss what their options are, and you need to know that answer right away. So not much can prepare you for that. If they did more scenarios of emergency-type cases and situations when you have people that are very emotional, that’s a very different scenario than most common role playing that we did, and that’s really valuable. So you have to figure it out. How to deal with the emotions, the medicine, the finances— it’s a lot.

Likewise, Jessie stated nothing prepared him for a euthanasia situation where he needed strong communication skills to handle it compassionately and professionally. Generally he feels he is good with people but he added, “certainly I have made some big mistakes, either over or under communicating things where I just had to log that in the back and had to say ‘alright, never do that again.’” He recalled some lectures on communication but the formal course on it was an elective and he regretted not taking advantage of that training. He explained,

looking back on it, knowing what would be good for me now, back then I didn’t have an appreciation for what those things were at the time. So I would never choose, with my own time, to do a client communication extra course on my own, but that should be something that is required ‘cause it’s good for me and I didn’t know it at the time and so, I didn’t know do it.

Yet, Jean felt strongly she needed to be in a very high-paced environment to really develop her skills so she could not even envision an aquatic internship, let alone veterinary school preparing her the way her small animal private practice internship did:

If I had gone straight into an aquatics internship, I don’t think I would have been as strong after that year, just overall, because not only the clinical knowledge I gained, just everything else regarding how I wanted to be professionally and those kind of skills. I don’t think they really can teach you in vet school until you have the opportunity to get into a high case load, busy, emergency practice when you’re dealing with stress and
clients and many, many different personalities. For me at least, I needed to be thrown in.

**Insights on employers' results.** After the interviewees spoke about their non-technical training and their level of preparedness, they were informed that when the survey results were analyzed, the recent graduates seemed more confident in their teamwork and communication skills than employers reported. They were then asked if they had any insights as to why this difference exists. Each person came up with different reasons for why this occurred except Sally who wasn’t sure why employers would say their teamwork and communication skills need more development because there seems to be a fair amount of emphasis on these skills. A couple people prefaced their thoughts by saying they were not surprised by the finding while others were caught more off-guard.

Stanley and Billy both remarked on generational differences but their points were fairly different. Stanley focused on the electronic communication that dominates today’s workplace and Billy discussed the uniqueness mindset of millennials. Beth reasoned that veterinary school promotes a very Type A personality which leads to more of an inability to take constructive criticism and she added that the veterinary students whom she’s worked with, while very excited to be there, are often focused on their own education and not team-oriented.

The most similar responses were from Jessie and Jean who mentioned expectation differences but their explanations were each unique. Jessie shared how in his internship he thought he was doing well but was told he needed to improve in certain areas. This was frustrating for him because he was not provided with clear expectations at the onset so he had no idea he wasn’t meeting their standards; it wasn’t that he
couldn’t do things differently or was too lazy to do something the way they wanted.

Conversely, Jean hypothesized,

the bar which [employers] are satisfied is always higher because they always tend to want their employees to continue to excel and they always find new ways for people to improve upon themselves. There is always critique you can give. So, while you may feel like you are doing a job adequately, I think the employer’s role is always to evaluate their employees and say how they can be better. So, it’s not necessarily that I think people are overconfident and view themselves as excelling when they’re not, it may just be the employers just always expect more.

Therefore, since there can always be improvements, employers are always going to focus on those more so than employees, who may focus more on their successes.

Jessie also described how he had trouble connecting with the senior clinicians in his first position and how different it was from working with people at his same level. He had feelings of self-doubt and intimidation because, as he describes, he was working with people who are very, very advanced and knowledgeable and all of a sudden you sometimes feel like ‘Do I belong?’ or ‘How is that we are both sitting at the same table talking about the same thing?’ We seem to be on really different levels … We are both DVMs [but you] really become aware of the stratification of where you are versus where you want to be … How much do we talk? How much do we joke? When do we be serious and when do we act like we’re more on a casual level? Sometimes it can be hard to feel out those moments …

So, recent graduates may be struggling with communication out of discomfort with or fear of exposing their shortcomings to their employers whom they revere.

**Mentorship and Collegial Support**

Frequently credited with helping to prepare interviewees for their career was the mentorship they received. Multiple times references were made about calling upon mentors from their alma mater or internship institutions for assistance with cases at their current location. Oftentimes, these relationships were formed during the experiences that happened outside of the classroom and were more informal. Stanley credited the
International Association for Aquatic Animal Medicine with providing terrific mentorship to students through their welcoming conference environment and financial assistance to students. Jessie spoke about responding to marine mammal strandings and explained, “that might have been one of the more important aspects of it, is the time outside of the classroom where we were able to come together as a team, a group of people who have a very special interest, who can learn to be colleagues and friends as well as professionals.” One interviewee also described how she relies on her veterinary colleagues as a resource too:

... I have really good mentors who I know that can call if I have questions and they’re happy to chat and talk about cases and things like that. Having those people to reach out to works really well. I also work alongside several other vets and we like to throw our heads together and talk about cases too. So it’s not like I’m always by myself. Certainly I can make a decision, but it’s nice to have other resources to team with on cases that are tricky, or you feel like you’re not making positive strides or as fast as you want to.

Beth said she would have liked even more social interaction opportunities with faculty. She understands faculty are already overworked, so she suggested a regular happy hour or dinner event that would be relaxing for them too but where students would feel comfortable asking questions. These events would help to foster relationships, potentially leading to future learning opportunities. Jessie also noted the informal settings outside of the classroom helped to build a relationship with his mentors. The most impactful professors connected with him on a personal level too. He remarked,

the things that I really regarded about them was their ability to develop a relationship with me as a person and not just me as a student. Those people, they opened themselves up to be available to me, not just in the classroom but also send me an email anytime, making me feel like once I was a vet student, I was a part of the profession already at that time and I could look at them and they could look at me as colleagues.
He then went on to say, “That should be a good goal because you know in a few short years it’s not going to be teacher/student, it’s going to be colleague/colleague and starting to emulate that really early on, really helped me feel comfortable at the time and has helped me at the first stages of my career.” Likewise, Billy suggested faculty should strive to be personable with students because it makes it a more inviting environment for questions which improves learning.

Sally proposed mentorship should play a larger role in the pre-veterinary student’s preparation as well. Academic professionals should help to guide students in their career options so students with talent and potential for success in the non-traditional veterinary career paths are informed of the diversity in veterinary career paths and are encouraged to pursue it. Acknowledging how exhausting it must be for educators with more and more students, she encourages them to continue to put forth that level of effort because it led to her success. She remarked,

I have more and more students coming to me looking for opportunities. I don’t take them lightly, I really do think mentoring is a big part of how I got to fulfill my greatest aspirations, and it was not necessarily because I’m special, it was because my mentors were special. I think that the best thing that I can do to give back is to try to… I will never be as good a mentor as the ones that I had, ’cause they were so amazing, but to just try to emulate that.

Similarly, Jessie commented that while interested in exotics, he was pulled into aquatic animal medicine in part because of the passion of the AAH faculty that taught him. Beth encouraged educators to maintain their passion in the classroom because it really helped her to learn. She noted enthusiasm must be tough to maintain with so many students these days on their computers and phones.

In addition, mentorship also came up when interviewees were asked to explain their choices for rankings of different candidates for an entry-level position at their
institution. The first question of this type had four applicants to choose from, each with one year of experience in a different position. The first three had just completed an internship, one in zoological medicine at a university, the second also at a university but in internal medicine, and the third at a small animal corporate private practice in internal medicine/surgery. The fourth candidate spent one year as a clinician at a small animal private practice. Most interviewees felt this was a difficult decision and they struggled with so little information. For example, Jean explained, “certain internships are stronger than others … and what kind of private practice is it? Is it a two doctor practice versus a ten doctor practice? What kind of caseload? So, it’s just tricky to give a strong answer to that knowing that there are many differences and no program is like one other.” Likewise, Beth explained, “a lot of it is on-the-job and learning from your mentors and stuff. So, the person who did an academic internship potentially could be better than the person who did zoo and exotics, it just depends on their situation and what they spent that year doing and who their mentors were. How they respond to situations too.”

So, their perceptions of the mentorship they received and the caseload in different organizations seemed to be the dominant factors driving their choices because they knew the quality of mentors was highly variable and the quantity of the cases, as well as the complexity level of the cases, could be drastically different. Focusing on the quality of the mentorship, Jessie said that in private practice, “there is always the danger of just becoming just low paid work,” whereas “it seemed to me that in academic positions there was much more emphasis on research and doing journal reviews and the academic portion of really sitting and learning how things go.” Yet, Jean did her internship in private practice and she thought she received plenty of mentorship as well.
as independent responsibility (such as managing an overnight) so she valued that more than the university experience. In addition, Jean offered this example regarding caseload experience:

if you're going straight into small animal general practice, that practice may not see any emergencies. They might refer all cases. They might not perform their own ultrasounds. Just not knowing what kind of level they do for a diagnostic, it may be just someplace- spay, neuter, vaccines and wellness. If they turf all sick cases, that's not really a strong clinician you would take on.

Alternatively, Sally ranked the clinician above the small animal interns because they are more likely to be flexible and comfortable working with less tools which is important in fieldwork. Jessie also noted, even though he prefers an academic training like he did, many AAH veterinarians started in small animal practice and he has observed the benefits of that style to case approach.

**Expectations and Career Satisfaction**

Since student expectations are a known factor of career satisfaction (relationship shown in Figure 2-1), the interviewees were asked to describe any unexpected outcomes from their careers. Where they became employed was a common theme. One didn’t expect to do an internship at a zoo, another didn’t expect to be selected by such prominent organizations, and someone else was surprised to not work in academia, and instead start a business. Alternatively, one interviewee was surprised by the amount of clinical work she does in her job since her intention, when starting veterinary school, was to focus on research in her career. One of the residents was surprised by the amount of professional growth that occurred during her residency. She expounded,

I thought after the internship I had grown a lot as a person and a veterinarian, but I’ve done even more so in the past three years. I’ve
learned to deal with a lot of different personalities and many different work
environments, which is very important. I have a better idea of what kind of
veterinarian and kind of coworker I want to be going forward. I’ve gained a
lot of insight of how to discuss certain issues that are controversial, such
as the whole animals in captivity debate that continues. … sometimes they
say you’re an advocate for your animal and for your patient; I really grew
to understand what that is in this residency.

Lastly, one interviewee stated there has not been any unintended outcomes.

While all of the interviewees were somewhat to very satisfied with their career,
the residents were more hesitant to judge their career satisfaction. One resident
explained she doesn’t feel like she’s started her career yet; she doesn’t even have
authority to make changes in staff operations. The other resident gave the caveat that
her satisfaction level could change drastically in the next year or two since she is about
to finish her residency and start in a brand new role. All of the other recent graduates
who were interviewed were employed in positions other than residencies nor
internships.

Additionally, several interviewees expressed expectations of a steep learning
curve at the start of their career. Jean admitted, “So it’s tough. But I chose a private
practice internship where I would have a high case load so I could manage that on my
own and learn where my strengths and weakness were and by the end of the year I
became very proficient.” Another person commented, “it’s just how early that I am. I
have kind of jumped straight into clinicals so I am reading and learning as I go. If I had
more lectures I think that might help, but I also learn really well by doing and gettin’ my
hands dirty. So I’ve learned to adapt and extrapolate from what I know.”

**Continuing Education**

As discussed in the research section, continued learning is an important
component of being an AAH veterinarian. Stanley commented on how this has impacted
the curriculum saying, “now there’s more and more that’s being taught in vet school and it’s almost like you’re skimming over more, ‘cause we learn more …” Thus, she continued, “when we all graduate we’re all generalists, we’re not really specific in anything. We may have an area that we want to practice in but it takes a while to hone that skill and you probably have to be out 10 to 15 years before you can say you’re really an expert in whatever.” As such, continued education was perceived as valuable to the interviewees beyond fulfilling the requirement of their licensure.

A couple interviewees discussed specific courses their employers required them to attend, but mostly it was self-directed. Conferences were the main source of continuing education noted by the interviewees. Not only do they benefit from attending and listening to presentations but, as one interviewee noted, employers benefit when their employees present their research. This is a very important aspect for the government employee because her boss has to justify all travel and they are not budgeted for licensure requirements so outreach activities are the driving force.

Additionally, online communities were mentioned by a couple people as sources of continuing education opportunities. When asked if they have considered short courses like AQUAVET or Diseases of Warmwater Fish for continuing education, interviewees mostly responded the courses would cover too little new material to be worthwhile. Some other reasons provided were they would be harder to attend, since they are often longer than one week, and are very costly. As a student, Stanley decided to spend the summer interning at a rehabilitation facility instead of attending several short courses because the courses were expensive and she’s have more travel costs for fewer weeks of training.
Alternative Careers and Debt Awareness

Many interviewees spoke about their back-up career plan since the aquatics specialty is so small and there are so few positions available. “I still wanted to do marine mammals at that point, but knew that a veterinary degree could take me away from it and I was open to working with other wildlife, whether it was terrestrial or whatnot and ultimately came back around to marine mammals,” Sally explained. She added,

I knew that wanting to combine marine mammals and veterinary medicine was going to be a narrow niche and I also had, and still do have, an interest in livestock. So, I was figuring, ‘Alright, I’m going to be spending all this time, energy, money and everything into going to vet school. Plan A might realistically not work out. So I gotta know what Plan B and C might look like’ and that was the other thing that I liked about going [to my alma mater], was there was bigger wildlife focus, it was conservation-focused, but at the same time there was really good potential to do livestock as well, if I needed to. Because I knew I wasn’t going to be the person going to small animal practice as a back-up plan.

Jessie also had a Plan B and C, in wildlife and exotic companion animal practice, respectively. He warns students to consider if they’ll be happy as a veterinarian not working with marine mammals because they need to prepare for that possibility:

I guess one of my big things I say is, if this is the only thing you want to do, like you wouldn’t want to be a vet if you couldn’t work with marine mammals, then maybe you should reconsider. Because honestly, the competition is just so incredibly ridiculous that you can do everything right, you can have the best grades, and you can have the best this and the best that, and you might find yourself consistently feeling like you’re shut out of getting into this profession in any kind of impactful way.

In addition, Stanley encouraged students to make fiscally-sound choices as they consider different training opportunities. She warned that multiple internships will not only impact your quality of life but delay your ability to pay back your veterinary school loans, which will significantly increase your interest fees:

So if you spent five years of post-graduation in internships or just volunteering, you’re gonna commit financial suicide and it’s just not a
responsible thing to do. So, it’s hard to explain that happy medium to the
students who just want the job. ‘Make sure you take care of yourself. You
have to pay your bills. You have to eat.’ So it’s finding that balance ‘cause
a lot of them don’t realize it. I knew how much vet school cost when I went
to school, but you really don’t have a good handle on the interest rate that
applies as you go, ‘cause when you graduate you are like, ‘Oh my
goodness, I owe this! I could own a house and I don’t.’ So that’s hard.
That’s why a lot of people when they graduate, they say, ‘Do I do a small
animal internship where I make 25 or 30,000 or do I go straight private
practice and make 60 to 70?’ It’s a big deal to people. It’s hard, and if you
work for 20 or 30,000 for multiple years, that’s really hard. You gotta hope
your car doesn’t break, things like that. You gotta hope you stay healthy,
because you’ll be in trouble. [Plus,] all the places that you move to, they
don’t necessarily help you get there, and that’s an expense too that you
have to eat. It’s tough.

Similarly, Jean stated that educators should have better prepared her for her current
financial situation. While she may not have made different career choices, she could
have taken other steps to become more financially-secure:

I don’t think knowing potential salaries of what I would make would have
changed my willingness to pursue this field, but maybe it would have, I’m
not sure. I did not go into this field to become rich, so I don’t know if I
would have weighed different specialties differently. Maybe I would have
altered the amount of loans I had taken out to decrease my debt, pursued
other sources of income, particularly in the summers I had off. I may have
just been more proactive I think.

Jessie also described salary issues in the profession saying, “the salaries that we, I say
‘we’ as a veterinary community, are either offering or willing to accept, sometimes I think
it’s really sad … I think they are a bit of a joke. For some of these positions where they
are asking for someone to have all of this experience and then they are offering starting
salaries [of] $65,000 and I’m like, ‘Are you kidding me?’”

However, Jessie stated it is not just salary but a geographic restriction and a
family to consider that has kept him from finding full-time AAH employment. Additionally,
when he has applied for marine mammal jobs, he was told they are only considering
residency-trained applicants. He expressed his frustration about his situation saying,
‘What the heck did I spend all this time doing these [high level] internships for if I’m still probably stuck on ground zero unless I do a residency?’ There has to be somewhere where I could work at a high level and be regarded as somebody who is adequately trained and is capable in this field, having not done a residency. That doesn’t seem like it has to be everybody’s path to success.

Interestingly, this contrasted with Stanley who said, “there is no one way to do it. If you look across all the major facilities and you asked each person how they got into their spot, they tell you a totally different story, which I think is really cool.” Separately, Stanley also noted she has to explain to people who ask about her interest in becoming board certified that she would not leave her position to complete a residency because that would ultimately only better qualify her for the same job that she has now (there’s no financial or promotional advantage).

These interviewees also often recommended careers in the AAH field that do not require a veterinary degree. They explained, since the interest in this career path exceeds demand, many more years of training is necessary which increases your debt but the ultimate salary is lower for AAH veterinarians than for other veterinary specialists (who already have a lower salary than similarly educated professionals in other fields). Beth explained why she would not become a veterinarian if she could do it again, “I enjoy what I do but the debt is going to be crippling when I am done … I guess it just weighs very heavily on me and I know I could have just stayed in the fish field and been relatively happy and maybe gone for a PhD and been debt-free.” She stated it was too late for her to change careers now because she can’t afford it, so she would share those feelings with students,

I would really strongly, I don’t know how to say this, ask them to consider doing something else in aquatic animal health then just being a veterinarian because there are so many people out there who contribute in significant ways and they are not veterinarians. That’s often devalued and
that’s unfortunate. The people that are out there every day working know more about the animals, they know more about diseases, and they have seen more things then potentially the vet does, who spends maybe five minutes with an animal. Aquatic Animal Health is not just veterinary medicine, it is the whole team of people involved in that.

Furthermore, Sally asks students who say they want to be like her to consider how they feel about working all weekend, on holidays, and receiving emergency calls at night. She is frank with them saying, “that’s how it is and it’s what we do for the animals and there are people that don’t always realize that.” She encourages them to become actively engaged in the field before veterinary school (as did Beth). Her advice is, you might think you know what you want to do, but until you actually get involved and start doing those things experiencing those things, you probably don’t actually know, and I follow that up by saying, ‘Be open to change.’ I think one of the scariest things is- you have grown up thinking, knowing, that you were going to be a veterinarian, and to suddenly realize it’s not for you, is very scary. Again, to know that there are so many options out there that you don’t have to be that narrowly focused path.

So, for Sally, this warning was about time devotion to the job, not debt, but it was in conjunction with her previous recommendation about the small job market. Ultimately, she feels the best method for determining if it is the right career path, is to experience a variety of AAH roles.

**Summary**

In this three-phase responsive evaluation study, the views of employers and recent graduates on AAH preparedness were explored. Technical and non-technical need-at-entry knowledge and skills were investigated. The majority of employers responded the average recent veterinary graduate does not have the knowledge or experience needed in any of the aquatic taxon categories (mammals, fish, birds, invertebrates, reptiles, and amphibians) to meet their organization’s needs. The largest deficiency is in fish medicine (both fresh and saltwater species). Alternatively, the
majority of recent graduates felt they met the needs of their first position in all taxons except amphibians and invertebrates.

Nevertheless, employers and recent graduates are mostly in agreement about the importance of non-technical skills. One notable difference was Honesty/Integrity was most important to employers whereas Work ethic was most important to recent graduates (both were viewed by employers as commonly possessed by veterinary colleagues). Teamwork/Interpersonal skills was valued second most by employers yet listed first for commonly needing improvement. This was closely followed by Communication and then Time management as areas in most need of improvement amongst DVM employees and colleagues. Yet, recent graduates mostly felt they met or exceeded the need for all non-technical skills except Business savvy.

Some of the recent graduates were also interviewed. From this data, major themes regarding workforce preparedness included preferences for active learning environments, commitment to maximizing elective learning opportunities, strong appreciation for mentors, and under-development of non-technical skills compared to technical skills. Interviewees also commented on their current careers, continuing education, and provided advice to others interested in this field.
CHAPTER 5
CONCLUSIONS

This study not only investigated need-at-entry knowledge and skills for Aquatic Animal Health (AAH) veterinarians but also their elective experiences, career satisfaction, and the job market outlook. Responsive evaluation acknowledges the diversity in values among stakeholder groups yet, it is just as important to recognize were these values align. With this in mind, it is important to not only identify where veterinary medical education could be improved to best meet employers’ needs (ex: fish health) and students’ needs (ex: active learning), but also to acknowledge when these values are the same (ex: non-technical skills). Key convergences and divergences between the employers’ and recent graduates’ perceptions are discussed herein as well as the implications for each stakeholder group.

Job Analysis

Job analysis data can be used by educators to tailor the curriculum and by students (and mentors) to guide realistic expectations to, ultimately, improve job performance and employee as well as employer satisfaction. One surprising take away from the job analysis data was how many AAH veterinarians have jobs with multiple organizations (employers = 32% and recent graduates = 28%). This suggests organizations hiring AAH veterinarians do not have enough work to employ them full-time. Alternatively, AAH veterinarians may be working more than 40 hours per week for the extra income. Further research on the reasons behind and the impact of working multiple jobs should be conducted.

Another unexpected finding was recent graduate respondents were more clinically-focused in their job duties than employers. This is likely a reflection of junior
veterinarians being assigned more clinical work in their job duties, since senior clinicians would be expected to have more administrative duties. But, it could be a reflection of an unknown bias in the recruitment methods or a misrepresentation of the group by chance. Another possibility is there are fewer available entry-level research positions than clinical positions. Since one of the goals of the profession is to expand the presence of veterinarians in the workforce, research opportunities for recent graduates should be promoted. Even smaller research projects within a clinically-focused position could act as a gateway for more substantial research activity in the future.

Fish were reported as being the taxon veterinarian employers worked with most often (42% of the time, on average), followed by mammals (30%). Only six veterinarian employers responded they do not work with fish at all. Thus, experience with fish should be required of students interested in zoological medicine, even for those pursuing a marine mammal medicine interest. Additionally, fish should be considered for inclusion on the North American Veterinary Licensing Examination®, especially as the profession moves towards higher placement of veterinarians in non-traditional positions.

Employers and recent graduates agreed Medicine and Surgery was more important, and Environment was less important, in the job duties of recent graduates than the duties of employers. However, recent graduates felt Anatomy, Physiology, and Taxonomy and Restraint were more important than employers rated them. This indicates recent graduates are more focused on basic subject areas when performing their job duties than employers expect. This difference could also occur because employers have so much experience they now undervalue these foundational areas of
AAH. Thus, employers should assess whether they should dedicate time to training new hires in these subject areas so as to improve their comfort level with them or counsel recent graduates on more appropriate areas to focus their skill development activities.

Relatedly, the weights of the nine subject domains on the American College of Zoological Medicine (ACZM) Qualifying Exam were disproportionate to the employers’ importance rankings. Based on the importance to employers it would be expected that the most questions would involve Diagnostics, but it is only the fifth largest category of questions (“ACZM,” 2012). Additionally, Communication, Education, and Administration rated fourth by employers in importance but only accounts for 3% of the exam questions (eighth place in domain weight, above Research). Furthermore, Restraint is the sixth most popular category on the exam but least important amongst employers. Moreover, Environmental, which is the heaviest weighted category at 18%, only rated seventh in importance by employers (“ACZM,” 2012). Thus, students interested in AAH careers should not solely use the ACZM exam weights to guide their training in different subject areas. Additionally, exam makers should consider adjusting questions to better align with employer views.

Workforce Preparedness

One key finding from Phase 3 of this study, which is also shown in the job satisfaction literature (Jelinski et al., 2009), was the important role mentorship plays in preparedness. Mentors were viewed as key resources before, during, and after veterinary medical training. Therefore, both educators and employers should spend time cultivating meaningful relationships on a personal level with these students/graduates to enhance preparedness. In addition, academic administrators need to recognize this time in faculty workloads and encourage faculty to devote more time to mentoring pre-
veterinary students as well. Relatedly, mentors should be comforted to hear how impactful their advice and friendship has been to the success of these young professionals and how appreciative they are of that personalized time.

One element mentors should ensure they discuss with students is how to maximize their training in the elective portion of their curriculum. If students do not already have research experience, it seems it should be encouraged for preparation of internship and residency job duties as well as for later in their career. Even if they are not directly involved in research, AAH, like most fields, is constantly progressing and veterinarians will need to critically evaluate the research to apply these advances in their work. Additionally, students may need encouragement to seek training opportunities not advertised through the university. Interviewees advised prospective students to take initiative in contacting professionals in sectors they would be interested in working because many training options are often not formalized but the opportunity exists.

**Technical Skills Training Improvements**

For workforce preparedness (also known as readiness), another major finding was the average recent graduate has not met employer knowledge and experience needs for *any* taxon. This was in gross contrast to the perceptions of recent graduates who felt they met the needs of the position for most taxa. A majority of recent graduates only identified invertebrates and amphibians as taxa areas where they were below needs. Expectations for knowledge and skills should be better addressed at the start of employment (and conveyed to students) to resolve this large incongruence in preparedness perceptions. In addition to employer responsibilities for overcoming the expectations difference, recent graduates play a role too. They can be proactive by
discussing expectations during the interview process. Furthermore, they can seek additional training in all taxa instead of being too narrow in their continuing education experiences.

Additionally, educators should work towards curriculum additions to better prepare students for entry-level positions. Employers identified exposure to more clinical cases as being the most helpful type of training needed. While clinical case exposure was chosen at a higher rate than coursework, the two are not mutually exclusive. Recent graduate interviewees identified case-based learning in the classroom as one of the more helpful learning experiences, as was any active learning environment. Yet, recent graduate respondents felt they needed both coursework and clinical cases equally (coursework received just one more vote). This could be tied to feelings of comfort with the typical didactic lecture hall environment where students have spent the majority of their formal education experiences. One recent graduate acknowledged she struggled with her preference for the traditional learning environment even though it seemed she benefitted more from case-based learning. Her advice was to find the balance between the two to maximize learning. It would likely also be helpful for students to receive training on how to make the most out of the varying learning experiences so they feel more comfortable with active learning strategies and capitalize on the benefits of each. Furthermore, active learning has been championed throughout pedagogical literature (Foust & Paulson, 1998; Prince, 2004) so curricular reform to emphasize this strategy is expected to benefit all students equally, not just AAH specialists.
Non-Technical Skills Training Improvements

For non-technical skills, employers and recent graduates were largely in agreement on the importance of each. Overall, work ethic and its core elements of interpersonal skills and initiative (Hill & Petty, 1995) were among the top four most important skills. The only major difference between the stakeholders being Work ethic was chosen first, on average, by recent graduates but ranked fourth by employers (first for them was Honesty/Integrity, in alignment with animal science employers [Slusher et al., 2010], which was third for the RGs). More closely, Motivation/Initiative was second for RGs and third for employers. Additionally, Teamwork/Interpersonal skills was fourth for RGs and second for employers.

The higher rating of Work ethic and Motivation/Initiative by RGs and not the associated Teamwork/Interpersonal skills suggests they have underlying feelings of being over-worked. In support of this impression, one recent graduate stated that interns outside of academia are more likely to be exploited as low-paid labor instead of being treated as an apprentice. Additionally, almost all interviewees spoke at great lengths of the higher debt-load incurred in pursuit of an AAH veterinarian career, so the importance of motivation and work ethic may be a reflection of the long hours worked (frequently in multiple jobs) in order to pay off student loans. Since they also frequently spoke of having to take initiative in their elective coursework in order to gain sufficient experience for establishment of an AAH career, the higher rating of Motivation/Initiative could be a reflection of that perspective (which may have dwindled for older professionals).

While the importance rankings, by employers and recent graduates, of non-technical skills may have been mostly in agreement with each other, they did not agree
with the National Association of Colleges and Employers (NACE) survey results. As discussed in Chapter 2, NACE consistently shows Communication as being the most important non-technical skill amongst employers (NACE, 2005; NACE 2010), but it averaged fifth for both AAH employers and recent graduates. However, lower-ranked NACE skills, including Computer Skills and Detail-oriented, were also perceived as less important by AAH professionals. Additionally, while Business Skills were frequently mentioned in the veterinary education literature as needing more priority, they were the least important skill in the eyes of AAH employers. Thus, there are some differences in non-technical skill needs amongst veterinarians. Also, there was a difference between some of the most important skills and the top skills needing further training. It seems most of the more important non-technical skills to both groups (Honesty/Integrity, Work Ethic, and Motivation/Initiative) are commonly possessed by recent graduates. However, it is unknown if there are specific experiences contributing to the strong showing of these skills or if influences outside of the curriculum and prior to veterinary school are stronger factors in their development.

In the interviews, recent graduates identified communication (often in the context of teamwork/interpersonal skills) as one of the main non-technical skills developed in veterinary school. Yet, it was frequently also recognized by recent graduates as one needing further development along with time management. In addition, employers identified Teamwork/Interpersonal skills, Communication, and Time management as the top three areas needing improvement. Since the literature review showed veterinary students do not value non-technical skills to the degree they do after graduation,
educators should spend time sharing these research findings to obtain buy-in at the start of formal non-technical skill training.

Specifically, time management techniques should be covered as none of the interviewees received formal training in this area; instead they discussed skill development as a trial and error process. Even though it was not one of the most valued non-technical skills, formal training in time management would seem to be of great benefit to the profession because it would potentially enable happier, less stressed employees, reducing the troublesome veterinarian burnout and suicide rates (Andrus et al., 2006; Hatch, P. H., Winefield, H. R., Croistie, B. A., & Lievaart, J. J., 2011; Shanafelt et al., 2012; Skipper & Williams, 2012; Williams et al., 2002; Woo & Postolache, 2008). Perceptions of time pressure, but not workload hours \( M = 53.84, \ SD = 14.34 \), was related to lower job satisfaction in primary care physicians (Williams et al., 2002). Yet, a work culture and professional ethic that supports work/life balance was also associated with higher satisfaction. Additionally, satisfaction is already lower in entry-level positions because of less workplace control (Williams et al., 2002). So, development of time management skills in the veterinary curriculum would hopefully alleviate some stress preemptively in entry-level positions, and thus improve career satisfaction at the onset. However, continuing education training on time management would likely provide similar outcomes for stress reduction and could serve as a mechanism for training educators who may not be modeling best practices.

Veterinary educators could improve their non-technical training by including more higher-order communication role-playing scenarios, such as a euthanasia conversation during an emergency visit. Kogan et al. (2004) discussed the benefits to more advanced
training scenarios in the veterinary medical curricula and several recent graduate discussed a need for higher-level training as well. Lastly, since many schools already use interviewing as part of their selection criteria (Turnwald, Spafford, & Bohr, 2001), an interviewer-facilitated, problem-based, team-learning activity could be added to provide further insights into candidates existing non-technical skills prior to admission; thereby self-selecting for stronger non-technical skills at the start of veterinary school.

This being said, as one recent graduate posited, the reported lack of preparedness of recent graduates by employers may not be as drastic as the data suggests. It is possible that employers have a tendency to be too harsh in their performance judgments, as a side effect of being in a role where they are continuously responsible for identifying areas of their employee’s performance that need improvement. For instance, recent graduates did not seem to overly depend on resources for problem-solving. Like employers, recent graduates felt about 58% of problem-solving required the use of resources whereas the remaining 42% was from memorized knowledge. Additionally, recent graduates were aware of the existence and necessity of lifelong learning in the profession. So, they could be cognizant of their weaknesses but perceive them as areas needing development for subject mastery not competency. Yet, mastery could be used by employers as the benchmark for competency in this high-level career.

**Job Market and Hiring Characteristics**

For students wondering how competitive they are against other job candidates, it is helpful to understand the typical experience level of veterinary students in AAH. Recent graduates had a variety of training experiences but, on average, they completed
ten weeks of externships (at least 50% AAH-focused) at two to three locations and took
three lecture-based courses (25% or more AAH-focused). Additionally, most
participated in at least one short course.

Another aspect recent graduates should consider during the job-seeking process
is the work environment of the positions offered. Interviewees warned of the importance
of caseloads and mentorships in evaluating the quality of an entry-level position.
Students should be counseled on the type of questions they can ask during an interview
to determine these factors. Students should also receive feedback on how to best
promote themselves in their cover letter to obtain these competitive positions. Since
internship experiences were viewed as highly variable, students should detail the
mentorship they received, their unsupervised work, and their caseload experience when
applying for positions after an internship.

As stated previously, on average, recent graduates recognized the large
proportion of problem-solving that requires resource use rather than memorization. Yet,
recent graduates failed to recognize the skill value of effective resource use that
employers saw in a job applicant. Therefore, recent graduates are too focused on
technical skill requirements and give insufficient consideration to the non-technical
components. Additionally, this indicates recent graduates are not aware of how to
promote their non-technical skills to employers in the job-seeking process and should
be counseled on this as well.

Interestingly, recent graduates with four years or less work experience were the
largest segment of new hires and were hired almost exclusively for internship positions.
Since many of these hires are for time-limited positions (internships are typically only
one year) it was expected to have higher rates for less experienced veterinarians. However, one recent graduate completed two internships at well-respected institutions but has experienced difficulty in finding full-time employment in AAH. Thus, there is legitimate concern there are insufficient opportunities for internship-only trained professionals to warrant participation in this economically-straining training position, especially multiple internships. Additionally, the existence of these low-paying internships contributes to the poor earnings of veterinarians. So, if recent graduates realized they likely would not benefit from these internships (in the form of job attainment), and thus stopped applying for them, those employers would be forced to create more market-competitive positions. Moreover, if employers were to subsequently hire the majority of interns they accepted, they would benefit from significant cost-savings (since training is resource intensive).

Nonetheless, on average, recent graduates were slightly more positive than employers in the stability of the job market for AAH veterinarians over the next ten years. They were only less confident in the stability of position availability in clinical aquarium medicine. For them, it was more likely to have a slight decrease in hiring, like Rehabilitation (which employers rated lowest). Aquaculture was perceived by both as more likely to have a slight increase in hiring. Additionally, recent graduates perceived the newer area of One Health as having the highest likelihood for a slight increase in hiring whereas employers rated it below Aquaculture. Overall though, the hiring market for all areas was projected to remain static by both groups.
Career Satisfaction

The majority of recent graduate respondents were satisfied with their current job (only one person was dissatisfied and one person was neutral). Moreover, all but one person said they were at least somewhat likely to pursue a career in AAH if they could do it all over again (one respondent was undecided). However, three recent graduates responded that they would be unlikely to very unlikely to become a veterinarian. This reflects higher satisfaction than an older study with Australian veterinarians (Heath, 1998), but is still concerning since there were fewer respondents in this study and because proper career counseling in the anticipation stage could have prevented some of this career path regret (Wendlandt & Rochlen, 2008). In the interviews, multiple recent graduates (including one of the unlikely to become a veterinarian again respondents) stated they tell students interested in an AAH career path to consider AAH jobs that do not require a veterinary degree. They encouraged them to consider the many other ways they could work with these species and have a rewarding a career without the long hours and high debt of a veterinarian career.

When considering the debt-load of veterinarians, it is also concerning how few recent graduates (23%) received a merit-based promotion or raise. While they are still early in their career, one would expect they minimally would have received a merit-based raise after proving their competence during their first year of employment (an objective indicator of strong job performance). However, only those who graduated in 2011 or earlier reported receiving a raise or promotion. Previous veterinarian workforce studies describe annual raises as common occurrences in the beginning of career (Heath, 1998; American Veterinary Medical Association, 2007), however more research
is needed on the earnings of merit-based raises versus base pay adjustments for cost-of-living increases. Additionally, bonuses and other fringe benefits should be included in future research studies to fully document compensation of high-quality performance. Thus, this study could only find subjective support for high career satisfaction and not objective support.

**The Future**

**Consideration of Radical Changes**

The aforementioned recommendations for various stakeholders are all ideas that can be incorporated into the existing educational and workforce systems. However, it is important to also consider more radical concepts for educational change. As mentioned in Chapter 1, the Association of American Veterinary Medical Colleges’ (AAVMC) Foresight Report proposed a restructuring of the post-baccalaureate, four-year veterinary medical education concept to an integrated curriculum starting with basic sciences in the first two years, followed by normal and abnormal body systems in the next two years, and ending with two years of training in one of eleven specialized tracks (Willis et al., 2007). This would be coupled with changes in the licensing exam. Their reasoning included the allowance of more training in specialties as the modern veterinarian should not be expected to become prepared for practice in any veterinary field within four years and adding time to a curriculum was an unacceptable alternative given the return on investment (Willis et al., 2007).

None of the recent graduates interviewed suggested drastic changes to their curriculum such as this. Additionally, most were satisfied with their curriculum. Only one person felt the training was too focused on small and large animal medicine and did not allow for sufficient specialization in AAH. However, the changes proposed would not
take away the elements of preparation that the recent graduates spoke positively about. Significant integration of active learning can exist in both formats. Additionally, this change does seem to pragmatically allow for greater pursuit of elective training for specialist career preparation as well as ensured coverage of key areas needed for entry-level, technical and non-technical competence. While several interviewees discussed how important externships, away from the teaching hospital, were for their preparedness, one noted difficulties with scheduling these activities during clinical time. If veterinary schools do not reformat as proposed by AAVMC, they should minimally review their tracking options to accommodate non-traditional students. For many hospitals this may mean a larger budget for staff so less students are required for provision of quality patient care.

While specialized training centers (centers of excellence) were proposed for the practical adoption of eleven different tracks in the new education structure, incurred student travel costs would likely make inter-collegiate training unfeasible (given the extensive debt concerns of graduates). However, an ACZM-sponsored taskforce recommended implementation of faculty exchange programs to better disseminate expertise in small fields as well as dual-enrollment online courses (Stoskopf et al., 2001). Although the recent graduates had limited online course experience and preferred more traditional classroom experiences, well-planned online courses could meet current training gaps and could be partnered with live guest faculty workshops for applied training and assessment, essentially a blended learning format.

**Recommendations for AAH Educators**

AAH educators should analyze their own programs for incorporation of these research findings. This is the first study to look specifically at the outcomes of AAH
veterinarians, thus provides unique insights on technical and non-technical needs of current students. Baring major structural changes to veterinary medicine curricula, AAH educators should focus on how students can become adequately trained through the elective portion of the degree and extracurricular experiences. Thus, AAH educators should ensure that there is sufficient opportunity for students to complete externships (gaining aquatic clinical case experience) and aquatic research (preparing them for conducting projects themselves and improving research analysis skills).

Additionally, fish medicine training in a predominately active learning environment should be mandatory for those interested in the area, which means adequate course offerings (so students are exposed to more fish cases than now). Education, with respect to taxa, should model the job analysis ratio (presented in Chapter 4). Also, AAH coursework and clinical clerkships should include (and highlight) non-technical skill development. Emphasis should be on teamwork, higher-order communication training, and time management. In these experiences, structured feedback sessions should be included to provide adequate time for skill level reflection (including acknowledgment when they have demonstrated entry-level position competency) and methods for improvement. Additionally, given the high dependence on mentors, a mentoring program should be structured with training for mentors on programmatic goals and guidance on relationship-building such as participating in activities outside of the university setting.

Lastly, resources for future reference should be made available (preferably electronically) and time should be spent teaching students how they should go about finding and analyzing the latest research after graduation. Since we know not everything
can be covered within the curriculum, fostering efficient, effective lifelong learning should be a fundamental goal. Additionally, AAH educators should work with professional organizations, such as the International Association for Aquatic Animal Medicine, to conduct workshops aimed at closing the entry-level skill gaps highlighted herein.

**Further Research Needs**

More outcome studies are needed to assess the development of skills after graduation for improved identification of what is essential for entry-level practitioners. This should be conducted by each school and compared to their specific curriculum map for each graduation class so subject area objectives can be assessed for novice need. Administrators must collect and archive details for each course in the curriculum to facilitate this research. Likewise, entry-level performance research that does not capture the graduation year and alma mater of respondents will only identify major deficiencies and will be insufficient for making tough decisions on what to remove from a curriculum. However, larger studies could serve as foundational tools for providing baseline evidence of objective measurement elements such as merit-based raises. Furthermore, it is important to ascertain the baseline level of technical and non-technical skills for monitoring of development. Recording of freshman non-technical skill level should be a priority.

Specifically for AAH-focused research, further investigation into the multiple jobs held by AAH veterinarians should be a priority. Previous employment studies have characterized the workforce in full-time equivalents and part-time workers but high rates of multiple jobs has not been previously reported for the profession. Driving factors could include the need for greater income by AAH veterinarians or organizational needs
that are satisfied by a part-time workforce. Confirmation should be sought that this is unique to this specialty as well as exploration into the impacts of multiple roles.

Similarly, a longitudinal study of AAH job market would provide key data for evaluating the effectiveness of efforts to expand One Health in the profession. Likewise, long-term data should track intern placement rates to assess the viability of this training program as method of workforce preparation. Additionally, monitoring of the entire veterinarian workforce over time will help with comparisons of AAH veterinarians to their peers. Current data (see Chapter 2) are conflicting, so the potential of an AAH veterinarian career relative to a traditional veterinarian career is difficult to gauge.

Lastly, more focused research studies could isolate specific entry-level skills needed within the subject areas, taxa, and non-technical areas covered in this study. Such research could identify differences between AAH organizations that were not uncovered with this initial investigation into entry-level AAH practitioner performance. However, to facilitate curriculum change, it is more pertinent to further investigate commonalities between specific deficits of entry-level veterinarians in all fields.

*Teamwork/interpersonal skills* and *Time management* should receive the same level of attention that *Communication* has received in the veterinarian educational literature.

**Summary**

Findings on workforce preparedness perceptions of employers and recent graduates include implications for technical and non-technical skill development in veterinary medical school and post-graduation. Actions for educators, administrators, employers, and students were all described to improve the readiness of veterinarians interested in a career in AAH. For responsive evaluation, both consensus and divergences in stakeholder views are important to consider. Helpfully, the differences
between employers and recent graduates are not directly in conflict with each other but each emphasized different components which, for pragmatic reasons, need to be taken into consideration when prioritizing improvements. Specific subjects for technical and non-technical skill development were discussed (such as more exposure to fish cases and higher-order communication role-playing scenarios) as was broader actions such as mentorship and active learning which are believed to benefit all veterinary students, not just AAH specialists. Mentorship was identified as greatly important to career success. Employers and educators could improve their guidance by emphasizing the challenging realities of the profession and discussing comprehensive plans of action for readiness and a lifetime of continued learning and improvement. Additionally, active learning was viewed as being the most beneficial, so greater incorporation of those techniques into the curriculum is strongly encouraged as educators shift towards outcome-based teaching practices.
APPENDIX A

NAVLE® TEST SPECIFICATIONS

Test coverage areas (listed below) are based on a 2010 Job Analysis. Test information was retrieved from https://www.nbvme.org/?id=26&page=NAVLE+Test+Specifications in 2015.

Activities:
I. Data Gathering and Interpretation (140 items)
   A. Obtain history, perform physical examination, and evaluate the environment (35 items)
      1. Gather information from client, trainer, herd manager, etc., by asking appropriate questions and using interpersonal skills to
         a. clarify concerns, presenting problems, and expectations
         b. identify possible epidemiological problems and public health concerns
         c. analyze previous medical history and/or production record
   B. Determine the status (normal/abnormal) of the animal(s) and/or environment by (24 items)
      1. Observation and physical examination
      2. Medical or production record evaluation
   C. Record pertinent information in a legible and orderly system of medical records to promote retrieval and sharing of information (11 items)
   D. Develop a problem list, and a differential diagnosis list (47 items)
      1. Correlate clinical signs or abnormalities with organ systems
      2. Formulate a complete problem list and differential diagnosis list(s), to determine the need to collect additional information
      3. Recommend relevant procedures to the client, trainer, herd manager, etc., to obtain specific information about the problem(s)
      4. Order or perform diagnostic procedures to further define the problem(s)
   E. Interpret collected information and establish a working or final diagnosis or conclusion (23 items)

II. Health Maintenance and Problem Management (140 items)
   A. Identify and evaluate prevention, treatment, and management options (64 items)
      1. Develop a plan of action by assessing the following
         a. expected outcome
         b. feasibility
         c. urgency
         d. client expectations
         e. economic considerations (e.g., ability to pay, value of animal)
         f. humane considerations including pain management
g. ethical and legal implications
h. environmental and public health implications
i. professional abilities, resources, and facilities

2. Communicate case management options and prognosis to the client, trainer, herd manager, etc., including prevention, treatment, and husbandry alternatives
3. Obtain assistance through information retrieval, consultation, and/or referral

B. Implement Plan of Action (47 items)
1. Obtain informed consent as needed from client or authorized representative
2. Protect animal and human health and the environment by doing the following
   a. order or perform indicated tests
   b. apply epidemiological principles
   c. comply with regulations (e.g., government, show, legal transport, drug use and withdrawals, organic vs. conventional)
3. Perform preventive and/or therapeutic procedures (surgical, medical, etc.)
4. Communicate to the client or staff procedures that will optimize compliance with the treatment plan
5. Monitor the effectiveness of preventive and/or therapeutic measures
6. Advise the client on relevant additional issues (e.g. nutrition, behavior, genetics, husbandry, production management and performance, environment, public health)

C. Assess outcome (29 items)
1. Evaluate interventions by
   a. reviewing existing data
   b. collecting additional information
   c. assessing client compliance
   d. validating working diagnoses
2. Modify therapeutic and preventative plans as needed

III. Professional Behavior, Communication, and Practice Management (20 items)
A. Conduct oneself in a professional, ethical, and legal manner
B. Adhere to regulations regarding the veterinarian client patient relationship
C. Pursue educational opportunities to enhance continued personal and professional development
D. Communicate and work effectively with colleagues and staff
E. Evaluate practice methods to enhance productivity and knowledge (e.g., task delegation, time management)
F. Educate staff and public in proper animal care and health
G. Ensure safety (e.g., occupational hazards, handling/restraint, drug interactions, food safety)

H. Address client concerns in an empathetic and understandable manner (e.g., crises, grief management, economic restraints, compliance issues)

I. Preserve and protect the human animal bond

**Species:**

- Canine: 70
- Feline: 68
- Pet Birds: 10
- Other Small Animals: 10
- Bovine: 45
- Porcine: 17
- Ovine/Caprine: 10
- Cervidae: 2
- Equine: 47
- Camelidae: 2
- Poultry: 6
- Public Health: 10
- Non-Species Specific: 3

Total: 300 items

(Each NAVLE form includes 300 scored items and 60 unscored pretest items)
APPENDIX B
EMPLOYER QUESTIONNAIRE

Q1 Thank you for taking the time to complete the following evaluation. The information you provide will be used to help us improve our Aquatic Animal Medicine Certificate program for University of Florida veterinary students. We are working with the American Veterinary Medical Association’s Aquatic Veterinary Medicine Committee and the American College of Zoological Medicine’s Job Task Analysis Report to include the most pertinent information. However, if you feel a topic has been overlooked or not covered fully enough, please feel free to include your views in the comment section at the end so we can improve our survey process and ultimately our Certificate program. Your participation in this survey is voluntary. You do not have to answer any question that you do not wish to answer. However, complete surveys are most valuable in interpreting responses and improving our program. We will keep your answers confidential to the extent provided by law. Your name will not be used in any report. We will only use your answers after they have been combined with the other respondents’ answers. We believe that there are no risks to you from participating in this study. There are also no direct benefits or compensation to you for participating. If you have questions about your rights, contact the UF IRB office, PO Box 112250, University of Florida, Gainesville, FL 32611. Questions about the survey should be directed to Heather Maness at htdaniel@ufl.edu Thank you in advance for your valuable feedback! Aquatic Animal Health Program UF College of Veterinary Medicine PO Box 100136 Gainesville, FL 32610 352-294-4198

Q2 I have read the information above, I CURRENTLY work in the field of aquatic animal health (primarily or partially), and I am willing to participate in the survey.

☐ Yes (1)
☐ No (2)

If No Is Selected, Then Skip To End of Survey

Q3 How long have you worked (partially OR primarily) in the field of aquatic animal health? Please adjust the slide bar to record your answer (max is 30 years, please use 30 years if you have worked in the field longer than 30 years).

______ Number of years (1)

If Number of years Is Empty, Then Skip To Prior to this survey, were you aware ...
If Number of years Is Equal to 0, Then Skip To Prior to this survey, were you aware ...

Q4 In the past five years, have you been involved in the hiring decision of a DVM for a position in the field of aquatic animal health (this includes the hiring of interns and residents)?

☐ Yes (1)
☐ No (2)
Q5 In the past five years, how many DVMs have you been involved with hiring (including interns and residents)?
- 1 (1)
- 2 - 3 (2)
- 4 - 6 (3)
- 7 - 9 (4)
- 10+ (5)

Q6 What is your role in the decision making process for hiring DVMs (including the hires of interns/residents)? (Please choose the BEST response)
- Always serve as the primary decision maker (1)
- Always served as part of the selection committee (2)
- Always serve as the primary decision maker or as part of the selection committee (3)
- Sometimes serve as the primary decision maker or as part of the selection committee (4)
- None of the above (Please explain your role below) (5)

____________________
Q7 What percentage of the applications met the following markers of professionalism?

<table>
<thead>
<tr>
<th></th>
<th>10% or less (1)</th>
<th>11 - 39% (2)</th>
<th>40 - 60% (3)</th>
<th>61 - 89% (4)</th>
<th>90% or more (5)</th>
<th>Does not apply (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content was presented in an organized manner (1)</td>
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<td>○</td>
<td>○</td>
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<tr>
<td>There were no spelling errors (2)</td>
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<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>There were no grammar errors (3)</td>
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<td>○</td>
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<td>○</td>
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<tr>
<td>The application contained only appropriate/relevant content (4)</td>
<td>○</td>
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<tr>
<td>Provided information was accurate (5)</td>
<td>○</td>
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<tr>
<td>All requested information was provided (6)</td>
<td>○</td>
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</table>

Q8 How would you describe the preparedness of interviewees (those selected from the applications to interview)?

- 10% or less were well prepared (1)
- 11 - 39% were well prepared (2)
- 40 - 60% were well prepared (3)
- 61 - 89% were well prepared (4)
- 90% or more were well prepared (5)
- Interviews were not conducted/I did not participate in the interview process (8)
Q9 Was the difference in preparedness attributable to the amount of prior work experience the candidate had?
- Yes, almost always (1)
- Sometimes (2)
- No (3)
- Unable to determine (4)

Q10 When reviewing DVM applications for an aquatic animal health position, how do you define "relevant" work experiences or internships? (Check all that apply)
- Primarily aquatic specific work experiences/internships (1)
- Primarily exotic/zoological medicine work experiences/internships (2)
- Large animal medicine or surgery work experiences/internships (3)
- Small animal medicine or surgery work experiences/internships (4)
- Any formal veterinary internship training program (5)
- Other (please specify in the box below) (6) ____________________

Q11 For these position(s), would a Master in Public Health (MPH) degree benefit the employee in their ability to satisfy job duties? (Please choose the BEST response)
- Yes, significantly increase their ability to satisfy job duties (1)
- Yes, slightly increase their ability to satisfy job duties (2)
- Unsure, may or may not increase their ability to satisfy job duties (3)
- No, would not provide any additional abilities to contribute to the successful completion of job duties (4)
- My hiring of DVMs has involved very different position descriptions so a statement on the overall benefit of an MPH degree cannot be made (5)
Q12 Of the DVM hires that you were involved in within the past 5 years, what was the experience level of each hire on their first day? (Select the number of hires that BEST fit each category of experience. If there were no hires meeting that category description check Not Applicable.)

<table>
<thead>
<tr>
<th>Experience Level</th>
<th>1 Hire (1)</th>
<th>2 Hires (2)</th>
<th>3 Hires (3)</th>
<th>4+ Hires (4)</th>
<th>Not Applicable (No hires in this category) (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand-new DVM graduate (within 3 months of graduation)</td>
<td></td>
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<tr>
<td>DVM with 1 year of RELEVANT work experience or a RELEVANT internship</td>
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<tr>
<td>DVM with 2 - 4 years of RELEVANT work experience/internships</td>
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<tr>
<td>Recently completed residency training and minimal other work experience</td>
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<tr>
<td>Diplomate and work experience OR over 10 years of relevant work experience</td>
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<td></td>
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<tr>
<td>DVM with 5 - 9 years of RELEVANT work experience/internships</td>
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</tbody>
</table>
Q13 How many of these hires were hired for an internship position?

<table>
<thead>
<tr>
<th>Number of intern hires</th>
<th>0 (1)</th>
<th>1 (2)</th>
<th>2 (3)</th>
<th>3 (4)</th>
<th>4+ (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand-new DVM graduate (within 3 months of graduation) (1)</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>DVM with 1 year of RELEVANT work experience or a RELEVANT internship (3)</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>DVM with 2 - 4 years of RELEVANT work experience/internships (4)</td>
<td>○</td>
<td>○</td>
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</tr>
</tbody>
</table>

Q14 The following set of questions pertains to YOUR education background and current position.

Q15 Do you have any of the following degrees/diplomate status? (Check all that apply)
- DVM (1)
- MS (2)
- MPH (3)
- PhD (4)
- DACZM (5)
- Other (please type degree(s) in the box below) (6) ____________________
Q16 In your current monthly job duties, how often do you spend time (if any) providing clinical care to aquatic animals?
- 0% (1)
- 1 - 5% (ex: 1 day/year or 2.5 weeks/year) (2)
- 6 - 10% (ex: 1.5 days/month or 1 month/year) (3)
- 11 - 20% (ex: 1 day/week or 1 week/month or 2 months/year) (4)
- 21 - 39% (ex: 1.5 days/week or 1.5 weeks/month or 3.5 months/year) (5)
- 40 - 60% (ex: 2.5 days/week or 2 weeks/month or 6 months/year) (6)
- 61 - 89% (ex: 3.5 days/week or 3 weeks/month or 9 months/year) (7)
- 90% or more of your time (ex: daily) (8)

Q17 In your job duties, what percentage of your time (if any) do you spend on research activities in aquatic animal health?
- 0% (1)
- 1 - 5% (ex: 1 day/year or 2.5 weeks/year) (2)
- 6 - 10% (ex: 1.5 days/month or 1 month/year) (3)
- 11 - 20% (ex: 1 day/week or 1 week/month or 2 months/year) (4)
- 21 - 39% (ex: 1.5 days/week or 1.5 weeks/month or 3.5 months/year) (5)
- 40 - 60% (ex: 2.5 days/week or 2 weeks/month or 6 months/year) (6)
- 61 - 89% (ex: 3.5 days/week or 3 weeks/month or 9 months/year) (7)
- 90% or more of your time (ex: daily) (8)

Q18 In which country do you live?
*Drop down box

Q19 What kind of organizations do you currently work for in your aquatics-related career? (check all that apply)
- Corporation (1)
- Government agency (2)
- Non-profit organization (3)
- Private practice (4)
- University (5)
- Other (Please specify in the box below. Ex: Independent contractor, Small business) (6) ____________________
Q20 Which organization would you classify as your PRIMARY job?
- Corporation (1)
- Government agency (2)
- Non-profit organization (3)
- Private practice (4)
- University (5)
- Other (Please specify in the box below. Ex: Independent contractor, Small business) (6) ____________________

Q21 Is the corporation that you are employed with primarily a zoo or aquarium?
- Yes, zoo/aquarium (1)
- No, other (2)

Q22 Is the non-profit organization that you are employed with primarily a zoo or aquarium?
- Yes, zoo/aquarium (1)
- No, other (2)
Q23 Use the scale below to indicate how important or not important each of the following subject areas is to YOUR position.

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>Not important (1)</th>
<th>Very minimally important (2)</th>
<th>Minimaly important (3)</th>
<th>Somewhat important (4)</th>
<th>Important (5)</th>
<th>Very important (6)</th>
<th>Extremely important (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment (incl. wild and captive ecosystems)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Medicine and Surgery (2)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Preventative Medicine (3)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Anatomy, Taxonomy, and Physiology (4)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Diagnostics (5)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Restraint (6)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Biologics and Therapeutics (ex: vaccines) (7)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Communication, Education, and Administration (incl. federal regulations) (8)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Research (9)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Q24 If supervising a DVM with less than 3 years of experience, how would you rate the following subject areas in their level of importance for successfully meeting job duties? Drag 3 subjects (items) into the most important box and 3 subjects into the least important box.

<table>
<thead>
<tr>
<th>Pick 3 as MOST important</th>
<th>Pick 3 as LEAST important</th>
</tr>
</thead>
<tbody>
<tr>
<td>______ A) Anatomy, Taxonomy, and Physiology (1)</td>
<td>______ A) Anatomy, Taxonomy, and Physiology (1)</td>
</tr>
<tr>
<td>______ B) Biologics and Therapeutics (2)</td>
<td>______ B) Biologics and Therapeutics (2)</td>
</tr>
<tr>
<td>______ C) Communication, Education, and Administration (3)</td>
<td>______ C) Communication, Education, and Administration (3)</td>
</tr>
<tr>
<td>______ D) Diagnostics (4)</td>
<td>______ D) Diagnostics (4)</td>
</tr>
<tr>
<td>______ E) Environment (5)</td>
<td>______ E) Environment (5)</td>
</tr>
<tr>
<td>______ G) Preventative Medicine (7)</td>
<td>______ G) Preventative Medicine (7)</td>
</tr>
<tr>
<td>______ H) Research (8)</td>
<td>______ H) Research (8)</td>
</tr>
<tr>
<td>______ I) Restraint (9)</td>
<td>______ I) Restraint (9)</td>
</tr>
</tbody>
</table>

Q25 The following questions relate to the different species that aquatic animal health professionals work with.

Q26 When hiring a DVM with less than 3 years of experience, what percentage of experience with the following species best meets the needs of your facility/organization? (The total for the five categories must equal 100%)

<table>
<thead>
<tr>
<th>Preffered percentage (%) of aquatic species experience (1)</th>
<th>Mammal (1)</th>
<th>Fish (2)</th>
<th>Bird (3)</th>
<th>Invertebrate (4)</th>
<th>Reptile/amphibian (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q27 With which of the following species do recent DVM graduates (within 2 years of graduation) typically need more experience with in order to perform well in the aquatic animal health duties at your facility/organization? Rank the following with ONE (1) being the species category in which the MOST additional experience is NEEDED by recent DVM graduates to perform well. (Drag the categories around so they are ranked from most to least need.)

- Amphibians (1)
- Aquatic birds (2)
- Aquatic invertebrates (3)
- Aquatic mammals (4)
- Aquatic reptiles (5)
- Fish (6)

Q28 Upon joining your facility/organization, how does the average new (within 1 year of graduation) DVM graduate's knowledge base and experience in the following aquatic species categories relate to the needs of your facility/organization?

<table>
<thead>
<tr>
<th>Species Category</th>
<th>Below needs (1)</th>
<th>Meets needs (2)</th>
<th>Exceeds needs (3)</th>
<th>N/A (not applicable to my facility/organization) (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic mammals (1)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Fish (2)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Aquatic birds (3)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Aquatic invertebrates (4)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Aquatic reptiles (5)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Amphibians (6)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Q29 Since you have identified the average new graduate as needing more knowledge or experience with an aquatic species group, please use the following matrix questions to provide further information on this topic.

<table>
<thead>
<tr>
<th>How would you describe the amount of training that is needed to meet your facility's needs? (Check all that apply)</th>
<th>More exposure to clinical cases needed (1)</th>
<th>More diversity in clinical cases needed (2)</th>
<th>More coursework/background knowledge needed (3)</th>
<th>More experience with scientific literature needed (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic mammals (1)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Fish (2)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Aquatic birds (3)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Aquatic invertebrates (4)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Aquatic reptiles (5)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Amphibians (6)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Q30 Is more knowledge or experience needed in freshwater species, saltwater species, or both?

<table>
<thead>
<tr>
<th>More knowledge/experience needed for...</th>
<th>Freshwater species (1)</th>
<th>Marine species (2)</th>
<th>Both (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish (2)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Aquatic birds (3)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Aquatic invertebrates (4)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Aquatic reptiles (5)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Q31 Of your time spent on aquatic animal-related issues (research, clinical, etc), what percentage is spent with each of the following aquatic species categories? (The total for the five categories must equal 100%)

<table>
<thead>
<tr>
<th>Percentage (%) of time spent on each aquatic animal category (1)</th>
<th>Aquatic mammals (1)</th>
<th>Fish (2)</th>
<th>Aquatic birds (3)</th>
<th>Aquatic invertebrate (4)</th>
<th>Aquatic reptiles/amphibians (5)</th>
</tr>
</thead>
</table>

Q32 The following two questions relate to hiring decisions between similarly qualified applicants.

Q33 Between the following DVM applicants with differing experience backgrounds, rank them in order of most likely (1) to be hired to least likely (4) to be hired at your organization for a junior clinical position. (Drag the categories around so they are ranked from most to least likely.)

- Applicant A with 1 year of experience as an internal medicine intern at a university (1)
- Applicant B with 1 year of experience as a zoological medicine intern at a university (2)
- Applicant C with 1 year of experience as an internal medicine/surgery intern in a small animal corporate private practice (3)
- Applicant D with 1 year experience as a clinician at a small animal private practice (4)

Q34 Between three interns with advanced beginner knowledge in aquatic animal medicine which would be more valuable?

- Intern A that has additional clinical competencies in aquatic animal medicine (from 1 year of work experience) (1)
- Intern B that has additional clinical competencies in small animal veterinary medicine (from 1 year of work experience) (2)
- Intern C that has additional abilities to effectively use educational resources (critically reviews scientific literature, more familiar with aquatic medicine resources, seeks specialist advice, etc) (3)

Q35 The following three questions relate to the professional qualities that you value.

Q36 When you are hiring a recent DVM graduate (within 2 years of graduation), what is the ideal percentage of memorized aquatics knowledge that they should
be able to immediately recall for problem solving? Since one would not be expected to know everything, adjust the percentages of the two categories to show the ideal percentage of memorized information versus use of other resources to problem solve. (Combined total must equal 100%.)

<table>
<thead>
<tr>
<th></th>
<th>Memorized knowledge/ Immediate recall (1)</th>
<th>Other (Ex: familiar with accessing and critically evaluating publications, consults specialist, etc) (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage (%) (1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q37 The following is list of skills/qualities often viewed as most important by employers. Please rank them from most (1) to least (11) important to you (drag the items up or down to rank them).

- ______ Analytical/Critical thinking skills (1)
- ______ Business savvy (2)
- ______ Communication skills (3)
- ______ Computer/Technical skills (4)
- ______ Detail-oriented (5)
- ______ Flexibility/Adaptability (6)
- ______ Honesty/Integrity (7)
- ______ Motivation/Initiative (8)
- ______ Teamwork/Interpersonal skills (9)
- ______ Time management (10)
- ______ Work ethic (11)
Q38 The following is a list of skills/qualities often viewed as most important by employers. Which of these are most commonly possessed by and which are in most need of improvement amongst your DVM employees and DVM colleagues? (Drag up to 3 items into each box)

<table>
<thead>
<tr>
<th>Skills/qualities commonly possessed by DVM employees and DVM colleagues (Pick up to 3)</th>
<th>Skills/qualities that commonly need improvement (Pick up to 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>______ Analytical/Critical thinking skills (1)</td>
<td>______ Analytical/Critical thinking skills (1)</td>
</tr>
<tr>
<td>______ Business savvy (2)</td>
<td>______ Business savvy (2)</td>
</tr>
<tr>
<td>______ Communication skills (3)</td>
<td>______ Communication skills (3)</td>
</tr>
<tr>
<td>______ Computer/Technical skills (4)</td>
<td>______ Computer/Technical skills (4)</td>
</tr>
<tr>
<td>______ Detail-oriented (5)</td>
<td>______ Detail-oriented (5)</td>
</tr>
<tr>
<td>______ Flexibility/Adaptability (6)</td>
<td>______ Flexibility/Adaptability (6)</td>
</tr>
<tr>
<td>______ Honesty/Integrity (7)</td>
<td>______ Honesty/Integrity (7)</td>
</tr>
<tr>
<td>______ Motivation/Initiative (8)</td>
<td>______ Motivation/Initiative (8)</td>
</tr>
<tr>
<td>______ Teamwork/Interpersonal skills (9)</td>
<td>______ Teamwork/Interpersonal skills (9)</td>
</tr>
<tr>
<td>______ Time management (10)</td>
<td>______ Time management (10)</td>
</tr>
<tr>
<td>______ Work ethic (11)</td>
<td>______ Work ethic (11)</td>
</tr>
</tbody>
</table>

Q39 ALMOST DONE! The following two questions relate to your perceptions of the aquatic animal health job market. The survey concludes with 1-3 questions on the UF Aquatic Animal Medicine Certificate Program, depending on your familiarity with the program, and an opportunity to provide further feedback on the topic of training DVMs for the field of aquatic animal health.

**Answer If List of Countries United States of America Is Selected**

Q40 How do you view the job market outlook for DVMs interested in the below areas of aquatic animal health over the next ten years? (Consider only the job
market in the U.S.A for every category except "International work" and "Other". If you are unfamiliar with the job market in a specific area, you may leave it blank.

<table>
<thead>
<tr>
<th>Category</th>
<th>Significant decrease in hiring (1)</th>
<th>Slight decrease in hiring (2)</th>
<th>Static hiring (similar to this year) (3)</th>
<th>Slight increase in hiring (4)</th>
<th>Significant increase in hiring (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical aquarium medicine (1)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Rehabilitation (2)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>One health (3)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Aquaculture (4)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>University faculty (5)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>International work (6)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Other (Please specify in the box below) (7)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Q41 If you were advising a DVM student, which of the following would you say has the best and worst markets for job opportunities in the next 10 years? (Pick up to TWO for each) (International aquatic medicine is considered outside the U.S.A.)

<table>
<thead>
<tr>
<th>Best TWO (2) job markets</th>
<th>Worst TWO (2) job markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>______ Aquaculture (1)</td>
<td>______ Aquaculture (1)</td>
</tr>
<tr>
<td>______ Aquarium medicine (2)</td>
<td>______ Aquarium medicine (2)</td>
</tr>
<tr>
<td>______ International aquatic medicine (3)</td>
<td>______ International aquatic medicine (3)</td>
</tr>
<tr>
<td>______ One health (4)</td>
<td>______ One health (4)</td>
</tr>
<tr>
<td>______ Rehabilitation (5)</td>
<td>______ Rehabilitation (5)</td>
</tr>
<tr>
<td>______ Small animal medicine (6)</td>
<td>______ Small animal medicine (6)</td>
</tr>
<tr>
<td>______ University faculty (7)</td>
<td>______ University faculty (7)</td>
</tr>
<tr>
<td>______ Zoological medicine (8)</td>
<td>______ Zoological medicine (8)</td>
</tr>
<tr>
<td>______ Other (Please specify in the box below) (9)</td>
<td>______ Other (Please specify in the box below) (9)</td>
</tr>
</tbody>
</table>
Q42 Prior to this survey, were you aware that the University of Florida offered a certificate in Aquatic Animal Medicine?
- Yes (1)
- No (2)

Answer: If Prior to this survey, were you aware that the University ... Yes Is Selected

Q43 Have you ever hired a graduate from the UF Aquatic Animal Medicine Certificate program?
- Yes, 1 person (1)
- Yes, 2 people (2)
- No (3)
- Don't know (Please explain in the box below) (4) ________________
- Yes, 3 people (5)
- Yes, 4 or more people (6)

Answer: If Have you ever hired a graduate from the UF Aqua... Yes, 1 person Is Selected

Q44 How would you rate the overall performance of that employee?
- Unacceptable (1)
- Below Expectations (2)
- Meet Expectations (3)
- Exceeded Expectations (4)
- Not Applicable (ex: was not involved in the management of the employee after hiring), please explain in the box below (5) ________________

Answer: If Have you ever hired a graduate from the UF Aqua... Yes, 2 people Is Selected

Q45 How would you rate the overall performance of each employee?

<table>
<thead>
<tr>
<th>Employee</th>
<th>Unacceptable (1)</th>
<th>Below Expectations (2)</th>
<th>Meet Expectations (3)</th>
<th>Exceeded Expectations (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee A (1)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Employee B (2)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Q46 How would you rate the overall performance of each employee?

<table>
<thead>
<tr>
<th></th>
<th>Unacceptable (1)</th>
<th>Below Expectations (2)</th>
<th>Meet Expectations (3)</th>
<th>Exceeded Expectations (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee A (1)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Employee B (2)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Employee C (3)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

Q47 How would you rate the overall performance of each employee? (if you have hired more than 4, please rate the most recent 4 employees)

<table>
<thead>
<tr>
<th></th>
<th>Unacceptable (1)</th>
<th>Below Expectations (2)</th>
<th>Meet Expectations (3)</th>
<th>Exceeded Expectations (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee A (1)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Employee B (2)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Employee C (3)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Employee D (4)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

Q48 Please include any comments you may have about this survey and our certificate program in the box below.

Q49 If we have any questions about your response, may we contact you for clarification?

- □ Yes (Please provide your e-mail address below) (1) ________________
- □ No (2)
Q1 Thank you for taking the time to complete the following evaluation. The information you provide will be used to help improve Aquatic Animal Health education for veterinary students. Your participation in this survey is voluntary. You do not have to answer any question that you do not wish to answer. However, complete surveys are most valuable in interpreting responses and improving our program. We will keep your answers confidential to the extent provided by law. Your name will not be used in any report. We will only use your answers after they have been combined with the other respondents' answers. We believe that there are no risks to you from participating in this study. There are also no direct benefits or compensation to you for participating. If you have questions about your rights, contact the UF IRB office, PO Box 112250, University of Florida, Gainesville, FL 32611. Questions about the survey should be directed to Heather Maness at htdaniel@ufl.edu Thank you in advance for your valuable feedback!
Heather Maness University of Florida PO Box 117345 Gainesville, FL 32610 352-294-2747

Q2 I have read the information above, I currently work in the field of aquatic animal health (primarily or partially), and I am willing to participate in this survey on my activities since beginning veterinary school.

- Yes
- No
If No Is Selected, Then Skip To Thank you for your participation. Ple...

Q3 What year did you graduate from veterinary school?

- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- None of the above ____________________
Q4 From which veterinary school did you graduate? (Choices are alphabetical by university name.)
- Auburn University - CVM
- Colorado State University - CVM
- Cornell University - CVM
- Iowa State University - CVM
- Kansas State University - CVM
- Lincoln Memorial University - CVM
- Louisiana State University - CVM
- Massey University - CS
- Michigan State University - CVM
- Midwestern University - CVM
- Mississippi State University - CVM
- Murdoch University - DV & BS
- North Carolina State University - CVM
- Oklahoma State University - CVM
- Oregon State University - CVM
- Purdue University - CVM
- Ross University - SVM
- St. George's University - SVM
- State University of Utrecht - FVM
- Texas A&M University - CVM & BS
- The Ohio State University - CVM
- The University of Edinburgh - Royal Dick SVS
- The University of Sydney - FVS
- Tufts University - SVM
- Tuskegee University - SVM
- Universidad Nacional Autonoma de Mexico - FMVZ
- Universite de Montreal - FMV
- University College Dublin - SAFSVM
- University of Calgary - FVM
- University of California - SVM
- University of Florida - CVM
- University of Georgia - CVM
- University of Glasgow - FVM
- University of Guelph - OVC
- University of Illinois - CVM
- University of London - TRVC
- University of Melbourne - FVS
- University of Minnesota - CVM
- University of Missouri-Columbia - CVM
Universities:
- University of Prince Edward Island - AVC
- University of Queensland - SVS
- University of Saskatchewan - Western CVM
- University of Tennessee - CVM
- University of Wisconsin-Madison - SVM
- VetAgro Sup - CVdL
- Virginia-Maryland CVM
- Washington State University - CVM
- Western University of Health Sciences - CVM
- None of the above

Q5 Taking everything into consideration, how do you feel about your veterinary medical education as a whole?

<table>
<thead>
<tr>
<th>Extremely Dissatisfied</th>
<th>Dissatisfied</th>
<th>Somewhat Dissatisfied</th>
<th>Neutral</th>
<th>Somewhat Satisfied</th>
<th>Satisfied</th>
<th>Extremely Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>veterinary education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q6 Please select all of the courses below that you have participated in as a student (Check ALL that apply):
- AQUAVET I
- AQUAVET II
- AQUAVET III
- AQUAMED
- Diseases of Warmwater Fish
- Envirovet
- Marvet
- SeaVet
- None of the above

If Please select all of the courses that you have participated in as a student: None of the above Is Not Selected

Q7 Of these courses, which ones were completed during veterinary school? (Check ALL that apply. If none, just continue to the next question without making a selection.)
Q8 How many lecture-based courses (classroom-based, online, or hybrid) have you taken that covered aquatic animal health topics as 25% or more of the syllabus? (The max is 10 courses. Please use 10 if you have taken more than 10 courses that meet this criteria.)

______ Number of courses

Q9 What percentage of the elective opportunities in aquatic animal health courses at your veterinary school did you participate in?

______ Percent (%) participation in aquatic electives

Q10 The following questions pertain to any aquatic animal health (50% or more of your time per week) externships that you may have completed during veterinary school. (Please use the max of 20 if your number exceeds 20.)

______ How many aquatic externships did you complete?

______ How many TOTAL weeks were spent on aquatic externships?

Q11 Do you have any of the following graduate degrees/diplomate status? (Check ALL that apply. If none, just continue to the next question without making a selection.)

- MS
- MPH
- PhD
- DACZM
- Other (please type degree(s) in the box below) ____________________

Q12 Have you completed any of the following? (Check ALL that apply using the most appropriate descriptor for EACH training experience.)

- Aquatic Animal Health Internship
- Aquatic Animal Health Residency
- Non-university-based Zoological Medicine Internship
- University-based Zoological Medicine Internship
- Zoological Medicine Residency
- None of the above
Q13 In your current monthly job duties, how often do you spend time (if any) providing clinical care to aquatic animals?
- 0%
- 1 - 5% (ex: 1 day/year or 2.5 weeks/year)
- 6 - 10% (ex: 1.5 days/month or 1 month/year)
- 11 - 20% (ex: 1 day/week or 1 week/month or 2 months/year)
- 21 - 39% (ex: 1.5 days/week or 1.5 weeks/month or 3.5 months/year)
- 40 - 60% (ex: 2.5 days/week or 2 weeks/month or 6 months/year)
- 61 - 89% (ex: 3.5 days/week or 3 weeks/month or 9 months/year)
- 90% or more of your time (ex: daily)

Q14 In your current job duties, what percentage of your time (if any) do you spend on research activities in aquatic animal health?
- 0%
- 1 - 5% (ex: 1 day/year or 2.5 weeks/year)
- 6 - 10% (ex: 1.5 days/month or 1 month/year)
- 11 - 20% (ex: 1 day/week or 1 week/month or 2 months/year)
- 21 - 39% (ex: 1.5 days/week or 1.5 weeks/month or 3.5 months/year)
- 40 - 60% (ex: 2.5 days/week or 2 weeks/month or 6 months/year)
- 61 - 89% (ex: 3.5 days/week or 3 weeks/month or 9 months/year)
- 90% or more of your time (ex: daily)

Q15 Is your primary job in aquatic animal health?
- Yes
- No

Q16 What kind of organization(s) do you currently work for in your aquatics-related career? (Check ALL that apply)
- Corporation
- Government agency
- Non-profit organization
- Private practice
- University
- Other (Please specify in the box below. Ex: Independent contractor, Small business)
____________________
Q17 Which organization would you classify as your primary aquatic animal health job?
- Corporation
- Government agency
- Non-profit organization
- Private practice
- University
- Other (Please specify in the box below. Ex: Independent contractor, Small business)

Q18 Is the corporation that you are employed with primarily a zoo or aquarium?
- Yes, zoo/aquarium
- No, other

Q19 Is the non-profit organization that you are employed with primarily a zoo or aquarium?
- Yes, zoo/aquarium
- No, other

Q20 Taking everything into consideration, how do you feel about your job as a whole?

<table>
<thead>
<tr>
<th>Job satisfaction</th>
<th>Extremely Dissatisfied</th>
<th>Dissatisfied</th>
<th>Somewhat Dissatisfied</th>
<th>Neutral</th>
<th>Somewhat Satisfied</th>
<th>Satisfied</th>
<th>Extremely Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
If Is your primary job in aquatic animal health? No Is Selected Or What kind of organization(s) do you currently work for in your aquatics-related career? (check all that apply)

Q21 Taking everything into consideration, how do you feel about your primary aquatic job as a whole?

<table>
<thead>
<tr>
<th>Job satisfaction</th>
<th>Extremely Dissatisfied</th>
<th>Dissatisfied</th>
<th>Somewhat Dissatisfied</th>
<th>Neutral</th>
<th>Somewhat Satisfied</th>
<th>Satisfied</th>
<th>Extremely Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Q22 Use the scale below to indicate how important or not important each of the following subject areas are to your first position.

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>Not at all Important</th>
<th>Very Unimportant</th>
<th>Somewhat Unimportant</th>
<th>Neither Important nor Unimportant</th>
<th>Somewhat Important</th>
<th>Very Important</th>
<th>Extremely Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment (incl. wild and captive ecosystems)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicine and Surgery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preventative Medicine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anatomy, Taxonomy, and Physiology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnostics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restraint</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biologics and Therapeutics (ex: vaccines)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication, Education, and Administration (incl. federal regulations)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Q23 Upon starting your career in Aquatic Animal Health, how did your skill set in the following categories relate to the needs of your first position?

<table>
<thead>
<tr>
<th>Category</th>
<th>Below need</th>
<th>Met need</th>
<th>Exceeded need</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment (incl. wild and captive ecosystems)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicine and Surgery</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Preventative Medicine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anatomy, Taxonomy, and Physiology</td>
<td></td>
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<tr>
<td>Diagnostics</td>
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<tr>
<td>Restraint</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Biologics and Therapeutics (ex: vaccines)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication, Education, and Administration (incl. federal regulations)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q24 Upon starting your career in Aquatic Animal Health, how did your knowledge base and experience in the following aquatic species categories relate to the needs of your first position?

<table>
<thead>
<tr>
<th></th>
<th>Below need</th>
<th>Met need</th>
<th>Exceeded need</th>
<th>N/A (not applicable to my 1st facility/organization)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic mammals</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Fish</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Aquatic birds</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Aquatic invertebrates</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Aquatic reptiles</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Amphibians</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Answer If Upon starting your career in Aquatic Animal Health, how did your knowledge base and experience in the following aquatic species categories relate to the needs of your FIRST position? - Below need is Selected

Q25 Since you have identified needing more knowledge or experience with an aquatic species group, please use the following matrix questions to provide further information on this topic.
Answer: If Upon starting your career in Aquatic Animal Health, how did your knowledge base and experience in the following aquatic species categories relate to the needs of your FIRST position? Fish - Below need Is Selected. Or Upon starting your career in Aquatic Animal Health, how did your knowledge base and experience in the following aquatic species categories relate to the needs of your FIRST position? Aquatic birds - Below need Is Selected. Or Upon starting your career in Aquatic Animal Health, how did your knowledge base and experience in the following aquatic species categories relate to the needs of your FIRST position? Aquatic invertebrates - Below need Is Selected. Or Upon starting your career in Aquatic Animal Health, how did your knowledge base and experience in the following aquatic species categories relate to the needs of your FIRST position? Aquatic reptiles - Below need Is Selected.

Q26: Is more knowledge or experience needed in freshwater species, saltwater species, or both?

<table>
<thead>
<tr>
<th></th>
<th>More knowledge/experience needed for...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freshwater species</td>
</tr>
<tr>
<td>Fish</td>
<td>☐</td>
</tr>
<tr>
<td>Aquatic birds</td>
<td>☐</td>
</tr>
<tr>
<td>Aquatic invertebrates</td>
<td>☐</td>
</tr>
<tr>
<td>Aquatic reptiles</td>
<td>☐</td>
</tr>
</tbody>
</table>
Q27 The following is a list of skills/qualities often viewed as most important by employers. Please use the scale below to indicate how professionally important or not important each of the items are to you.

<table>
<thead>
<tr>
<th></th>
<th>Not at all Important</th>
<th>Very Unimportant</th>
<th>Somewhat Unimportant</th>
<th>Neither Important nor Unimportant</th>
<th>Somewhat Important</th>
<th>Very Important</th>
<th>Extremely Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical/Critical thinking skills</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Business savvy</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Communication skills</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Computer/Technical skills</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Detail-oriented</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Flexibility/Adaptability</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Honesty/Integrity</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Motivation/Initiative</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Teamwork/Interpersonal skills</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Time management</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Work ethic</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Q28 Upon starting your career in Aquatic Animal Health, how did your skill set in the following categories relate to the needs of your first position?

<table>
<thead>
<tr>
<th>Category</th>
<th>Below need</th>
<th>Met need</th>
<th>Exceeded need</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical/Critical thinking skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business savvy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer/Technical skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detail-oriented</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexibility/Adaptability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Honesty/Integrity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivation/Initiative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teamwork/Interpersonal skills</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Time management</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work ethic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q29 The following two questions relate to hiring decisions between similarly qualified applicants.

Q30 Between the following DVM applicants with differing experience backgrounds, rank them in order of most likely (1) to be hired to least likely (4) to be hired for a junior clinical position in aquatic animal health. (Drag the categories around so they are ranked from most to least likely.)

- Applicant A with 1 year of experience as an internal medicine intern at a university
- Applicant B with 1 year of experience as a zoological medicine intern at a university
- Applicant C with 1 year of experience as an internal medicine/surgery intern in a small animal corporate private practice
- Applicant D with 1 year experience as a clinician at a small animal private practice
Q31 When choosing between three interns with advanced beginner knowledge in aquatic animal medicine, which would be more valuable?

- Intern A that has additional clinical competencies in aquatic animal medicine (from 1 year of work experience)
- Intern B that has additional clinical competencies in small animal veterinary medicine (from 1 year of work experience)
- Intern C that has additional abilities to effectively use educational resources (critically reviews scientific literature, more familiar with aquatic medicine resources, seeks specialist advice, etc)

Q32 When you are hiring a recent DVM graduate (within 2 years of graduation), what is the ideal percentage of memorized aquatics knowledge that they should be able to immediately recall for problem solving? Since one would not be expected to know everything, adjust the percentages of the two categories to show the ideal percentage of memorized information versus use of other resources to problem solve. (Combined total must equal 100%.)

<table>
<thead>
<tr>
<th>Percentage (%)</th>
<th>Memorized knowledge/ Immediate recall</th>
<th>Other (Ex: familiar with accessing and critically evaluating publications, consults specialist, etc)</th>
</tr>
</thead>
</table>
Q33 How do you view the job market outlook for DVMs interested in the below areas of aquatic animal health over the next 10 years? (Consider only the job market in the U.S. for every category except "International work" and "Other". If you are unfamiliar with the job market in a specific area, you may leave it blank.)

<table>
<thead>
<tr>
<th>Section</th>
<th>Significant decrease in hiring</th>
<th>Slight decrease in hiring</th>
<th>Static hiring (similar to this year)</th>
<th>Slight increase in hiring</th>
<th>Significant increase in hiring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical aquarium medicine</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
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<tr>
<td>One health</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Aquaculture</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>University faculty</td>
<td>O</td>
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<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>International work</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Other (Please specify in the box below)</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

Q34 If you could do it over again, how likely would you be to complete the following?

<table>
<thead>
<tr>
<th>Section</th>
<th>Very Unlikely</th>
<th>Unlikely</th>
<th>Somewhat Unlikely</th>
<th>Undecided</th>
<th>Somewhat Likely</th>
<th>Likely</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtain your veterinary degree</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Pursue a career in aquatic animal health</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>
Q35 Have you received a merit-based raise or promotion in an aquatic animal health veterinarian position?

<table>
<thead>
<tr>
<th></th>
<th># of Raises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merit-based raise</td>
<td></td>
</tr>
<tr>
<td>Merit-based promotion</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Yes, once</td>
<td></td>
</tr>
<tr>
<td>Yes, multiple times</td>
<td></td>
</tr>
</tbody>
</table>

Answer If Have you received a merit-based raise or promotion in an aquatic animal health veterinarian position? Merit-based raise - Yes, multiple times Is Selected

Q36 Please elaborate on the number of merit-based raises that you have received in the different aquatic animal health job positions that you have held.

<table>
<thead>
<tr>
<th></th>
<th># of Raises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position #1</td>
<td>0</td>
</tr>
<tr>
<td>Position #2 (if applicable)</td>
<td>1</td>
</tr>
<tr>
<td>Position #3 (if applicable)</td>
<td>2</td>
</tr>
<tr>
<td>3+</td>
<td>3</td>
</tr>
</tbody>
</table>

Q37 Please elaborate on the number of merit-based promotions that you have received with each organization that you have been employed with in an aquatic animal health position.

<table>
<thead>
<tr>
<th></th>
<th># of Promotions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization #1</td>
<td>0</td>
</tr>
<tr>
<td>Organization #2 (if applicable)</td>
<td>1</td>
</tr>
<tr>
<td>Organization #3 (if applicable)</td>
<td>2</td>
</tr>
<tr>
<td>3+</td>
<td>3</td>
</tr>
</tbody>
</table>
Q38 Please feel free to write any comments or concerns in this area.

Q39 After we analyze the responses, we will want to ask some follow-up questions for further detail in a few areas. May we contact you to set-up an interview time?

- Yes (Please provide your e-mail address below) (1) ______________________
- No (2)
First e-mail sent to the contact list of employers:

Subject line: Aquatic Animal Health Program at Univ. of Florida – Survey request

Hi [name],

We are writing to request your assistance with improving our Aquatic Animal Medicine Certificate Program so our graduates will best meet the needs of the profession. We are trying to get opinions on training areas for veterinary students in aquatic animal medicine from a diversity of people that work in aquatic animal health. We are working with the American Veterinary Medical Association’s Aquatic Veterinary Medicine Committee to identify representatives from different sectors (private practice, non-profit, government, etc). You are one of a small number of people that have been selected to participate in our survey since you represent one of these areas and you are or could be a supervisor of a graduate from our program.

Your participation in this survey is voluntary. You do not have to answer any question that you do not wish to answer. However, complete surveys are most valuable for interpreting responses and improving our program. We will keep your answers confidential to the extent provided by law. Your name will not be used in any report. We will only use your answers after they have been combined with other respondents' answers. We believe there are no risks to you for participating in this study. There are also no direct benefits or compensation to you for participating. If you have questions about your rights, contact the UF IRB office, PO Box 112250, University of Florida, Gainesville, FL 32611.

To complete the survey please click on the link: [hyperlink]

Thank you in advance for your valuable feedback. If you feel a topic has been overlooked or not covered fully enough, please include your views in the comments section at the end of the survey so we can improve our survey process and ultimately, our certificate program. You may also contact Heather Maness directly with any questions or concerns at htdaniel@ufl.edu.

We look forward to receiving your responses!

Sincerely,

Ruth Francis-Floyd, DVM, MS, DACZM
Iske Larkin, PhD
Heather Maness, MS
Tom Waltzek, DVM, PhD

UF College of Veterinary Medicine
Aquatic Animal Health Program
2015 SW 16th Ave
PO Box 100136
First reminder e-mail sent to the non-respondent employers:

Subject line: Second request- Survey by the Aquatic Animal Health Program at the Univ. of Florida

Hi [name],

We are writing to once again request your assistance with improving our Aquatic Animal Medicine Certificate Program so our graduates will best meet the needs of the profession. We are trying to get opinions on training areas for veterinary students in aquatic animal medicine from a diversity of people that work in aquatic animal health. Thus, your feedback is very important to this effort. You are one of a small number of people that have been selected to participate in our survey since you represent one of our target sectors of aquatic animal health (private practice, non-profit, government, university, corporation) and you are or could be a supervisor of a graduate from our program.

Your participation in this survey is voluntary. You do not have to answer any question that you do not wish to answer. However, complete surveys are most valuable for interpreting responses and improving our program. We will keep your answers confidential to the extent provided by law. Your name will not be used in any report. We will only use your answers after they have been combined with other respondents’ answers. We believe there are no risks to you for participating in this study. There are also no direct benefits or compensation to you for participating. If you have questions about your rights, contact the UF IRB office, PO Box 112250, University of Florida, Gainesville, FL 32611.

To complete the survey please click on the link: [hyperlink]

Thank you in advance for your valuable feedback. If you feel a topic has been overlooked or not covered fully enough, please include your views in the comments section at the end of the survey so we can improve our survey process and ultimately, our certificate program. You may also contact Heather Maness directly with any questions or concerns at htdaniel@ufl.edu.

We look forward to receiving your responses!

Sincerely,

Ruth Francis-Floyd, DVM, MS, DACZM
Iske Larkin, PhD
Heather Maness, MS
Tom Waltzek, DVM, PhD

UF College of Veterinary Medicine
Aquatic Animal Health Program
2015 SW 16th Ave
Final reminder e-mail sent to the non-respondent employers:

Subject line: FINAL Reminder to please complete survey from the Aquatic Animal Health Program at the Univ. of Florida

Hi [name],

We have written several times to request your assistance with improving our Aquatic Animal Medicine Certificate Program so our graduates will best meet the needs of the profession. We understand that you are busy but we ask that you please complete the survey by [date]. After that, we will close the survey for data analysis so it will no longer be accessible for you to add your perspective.

As a reminder, we are trying to get opinions on training areas for veterinary students in aquatic animal medicine from a diversity of people that work in aquatic animal health. Your feedback is very important to this effort. You are one of a small number of people that have been selected to participate in our survey since you represent one of our target sectors of aquatic animal health (private practice, non-profit, government, university, corporation) and you are or could be a supervisor of a graduate from our program.

Your participation in this survey is voluntary. You do not have to answer any question that you do not wish to answer. However, complete surveys are most valuable for interpreting responses and improving our program. We will keep your answers confidential to the extent provided by law. Your name will not be used in any report. We will only use your answers after they have been combined with other respondents’ answers. We believe there are no risks to you for participating in this study. There are also no direct benefits or compensation to you for participating. If you have questions about your rights, contact the UF IRB office, PO Box 112250, University of Florida, Gainesville, FL 32611.

To complete the survey please click on the link: [hyperlink]

Thank you in advance for your valuable feedback. If you feel a topic has been overlooked or not covered fully enough, please include your views in the comments section at the end of the survey so we can improve our survey process and ultimately, our certificate program. You may also contact Heather Maness directly with any questions or concerns at htdaniel@ufl.edu.

We look forward to receiving your responses!

Sincerely,

Ruth Francis-Floyd, DVM, MS, DACZM
Iske Larkin, PhD
Heather Maness, MS
Follow-up e-mail sent to consenting employers (which requests recent graduate contact information):

Subject line: Follow-up to Aquatic Veterinary Medicine Survey from Univ. of Florida

Hi [name],

Thank you very much for your participation in our previous survey. While preliminary results have been presented at IAAAM and ISAAH conferences, our research is still ongoing and further data is necessary for manuscript preparation. We would like to compare your responses on some of the survey items to those of recent veterinary graduates, as well as gather further information from them on their aquatic veterinary medical education experiences.

We ask that you please provide us with contact information for current or previous employees in aquatic animal health veterinarian positions (including interns and residents) that likely obtained their veterinary degree from an AVMA-accredited college between 2008 and 2014. We will then send them a link to the survey instrument which is similar to the one that you completed previously. If you prefer not to provide their contact information, we ask that you forward this message to them so they may elect to participate directly using the link below.

Your participation in this activity is voluntary. You do not have to answer any question that you do not wish to answer. We will keep all responses confidential to the extent provided by law. Your name will not be used in any report. We will only use your responses after they have been combined with other respondents’ data. We believe there are no risks to you for participating in this study. There are also no direct benefits or compensation to you for participating. If you have questions about your rights, contact the UF IRB office, PO Box 112250, University of Florida, Gainesville, FL 32611.

**Employers**- please provide contact information, or notify us of your participation through forwarding the e-mail (which will remove you from future reminders), by clicking here: [hyperlink]

**Recent DVM graduates**- please click on the link to complete the survey: [hyperlink]

Thank you in advance for your valuable feedback! Please feel free to contact Heather Maness with any questions or concerns at htdaniel@ufl.edu.

We look forward to receiving your responses!

Sincerely,
First reminder to the follow-up request which was e-mailed to non-respondent, consenting employers:

Subject line: Second request- Follow-up to Aquatic Veterinary Medicine Survey from Univ. of Florida

Hi [name],

We are writing to once again request your assistance with completing our research study. We very much appreciate your previous participation and respectfully request that you provide us with some further information. We would like to compare your responses on some of the survey items to those of recent veterinary graduates, as well as gather further information from them on their aquatic veterinary medical education experiences.

We ask that you please provide us with contact information for current or previous employees in aquatic animal health veterinarian positions (including interns and residents) that likely obtained their veterinary degree from an AVMA-accredited school between 2008 and 2014. We will then send them a link to the survey instrument which is similar to the one that you completed previously. If you prefer not to provide their contact information, we ask that you forward this message to them so they may elect to participate directly using the link below.

Your participation in this activity is voluntary. You do not have to answer any question that you do not wish to answer. We will keep all responses confidential to the extent provided by law. Your name will not be used in any report. We will only use your responses after they have been combined with other respondents’ data. We believe there are no risks to you for participating in this study. There are also no direct benefits or compensation to you for participating. If you have questions about your rights, contact the UF IRB office, PO Box 112250, University of Florida, Gainesville, FL 32611.

Employers- please provide contact information, or notify us of your participation through forwarding the e-mail (which will remove you from future reminders), by clicking here: [hyperlink]

Recent DVM graduates- please click on the link to complete the survey: [hyperlink]

Thank you in advance for your valuable feedback! Please feel free to contact Heather Maness with any questions or concerns at htdaniel@ufl.edu.

We look forward to receiving your responses!
Final reminder to the follow-up request which was e-mailed to non-respondent, consenting employers:

Subject line: FINAL Reminder to please respond to the research request from the Univ. of Florida

Hi [name],

We have written several times to request your assistance with completing our research study on aquatic veterinary medical education. We understand that you are busy but we ask that you please respond by [date].

As a reminder, we would like to compare your responses on some of the survey items to those of recent veterinary graduates, as well as gather further information from them on their aquatic veterinary medical education experiences. We very much appreciate your previous participation and we ask that you please provide us with contact information for current or previous employees in aquatic animal health veterinarian positions (including interns and residents) that likely obtained their veterinary degree from an AVMA-accredited college between 2008 and 2014. We will then send them a link to the survey instrument which is similar to the one that you completed previously. If you prefer not to provide their contact information, we ask that you forward this message to them so they may elect to participate directly using the link below.

Your participation in this activity is voluntary. You do not have to answer any question that you do not wish to answer. We will keep all responses confidential to the extent provided by law. Your name will not be used in any report. We will only use your responses after they have been combined with other respondents’ data. We believe there are no risks to you for participating in this study. There are also no direct benefits or compensation to you for participating. If you have questions about your rights, contact the UF IRB office, PO Box 112250, University of Florida, Gainesville, FL 32611.

Employers- please provide contact information, or notify us of your participation through forwarding the e-mail (which will remove you from future reminders), by clicking here: [hyperlink]

Recent DVM graduates- please click on the link to complete the survey: [hyperlink]

Thank you in advance for your valuable feedback! Please feel free to contact Heather Maness with any questions or concerns at htdaniel@ufl.edu.
We look forward to receiving your responses!

Sincerely,

Ruth Francis-Floyd, DVM, MS, DACZM
Iske Larkin, PhD
Heather Maness, MS

University of Florida
PO Box 117345
Gainesville, FL 32611
352-294-2747

First e-mail sent to the contact list of recent graduates:

Subject line: Aquatic Veterinary Medicine Survey Request from Univ. of Florida

Hi [name],

We are trying to gather information on aquatic animal veterinary medical education from a diversity of people that work in aquatic animal health (including interns and residents) and are recent graduates from an AVMA-accredited veterinary school (graduated between 2008 and 2014). You have been recommended to us by a current or former employer who has already completed a version of this survey. However, we also need the opinions of recent graduates on their veterinary curriculum experience to complete our research study.

Your participation in this survey is voluntary. You do not have to answer any question that you do not wish to answer. However, complete surveys are most valuable for interpreting responses and providing meaningful data. We will keep your answers confidential to the extent provided by law. Your name will not be used in any report. We will only use your answers after they have been combined with other respondents' answers. We believe there are no risks to you for participating in this study. There are also no direct benefits or compensation to you for participating. If you have questions about your rights, contact the UF IRB office, PO Box 112250, University of Florida, Gainesville, FL 32611.

To complete the survey please click on the link: [hyperlink]

Thank you in advance for your valuable feedback. If you feel a topic has been overlooked or not covered fully enough, please include your views in the comments section at the end of the survey so we can improve our study. Also, please feel free to contact Heather Maness with any questions or concerns at htdaniel@ufl.edu.

We look forward to receiving your responses!

Sincerely,

Ruth Francis-Floyd, DVM, MS, DACZM
Iske Larkin, PhD
Heather Maness, MS
First reminder e-mail sent to the contact list of recent graduates:

Subject line: Second request- Aquatic Veterinary Medicine Survey from Univ. of Florida

Hi [name],

We are writing to once again request your feedback on your veterinary education experience and career in aquatic animal health. As a reminder, you have been recommended to us by a current or former employer who has already completed a version of this survey and s/he believed that you likely graduated from an AVMA-accredited veterinary college between 2008 and 2014 and work in the field of aquatic animal health (including those employed as an intern or resident). We need the opinions of recent graduates, like yourself, on their veterinary curriculum experience to complete our research study.

Your participation in this survey is voluntary. You do not have to answer any question that you do not wish to answer. However, complete surveys are most valuable for interpreting responses and providing meaningful data. We will keep your answers confidential to the extent provided by law. Your name will not be used in any report. We will only use your answers after they have been combined with other respondents’ answers. We believe there are no risks to you for participating in this study. There are also no direct benefits or compensation to you for participating. If you have questions about your rights, contact the UF IRB office, PO Box 112250, University of Florida, Gainesville, FL 32611.

To complete the survey please click on the link: [hyperlink]

Thank you in advance for your valuable feedback. If you feel a topic has been overlooked or not covered fully enough, please include your views in the comments section at the end of the survey so we can improve our study. Also, please feel free to contact Heather Maness with any questions or concerns at htdaniel@ufl.edu.

We look forward to receiving your responses!

Sincerely,

Ruth Francis-Floyd, DVM, MS, DACZM
Iske Larkin, PhD
Heather Maness, MS

University of Florida
PO Box 117345
Gainesville, FL 32611
352-294-2747
Final reminder e-mail sent to the contact list of recent graduates:

Subject line: FINAL Reminder to please complete the Aquatic Veterinary Medicine Survey from the Univ. of Florida

Hi [name],

We have written several times to request your feedback on your veterinary education experience and career in aquatic animal health. We understand that you are busy but we ask that you please complete the survey by [date]. After that, we will close the survey for data analysis so it will no longer be accessible for you to add your perspective.

As a reminder, you have been recommended to us by a current or former employer who has already completed a version of this survey and s/he believed you could provide us with further information to complete our study. Our goal is to gather the opinions of those who graduated from an AVMA-accredited veterinary school between 2008 and 2014 and work in the field of aquatic animal health including employment with a non-profit, small business, government, university, or corporation.

Your participation in this survey is voluntary. You do not have to answer any question that you do not wish to answer. However, complete surveys are most valuable for interpreting responses and providing meaningful data. We will keep your answers confidential to the extent provided by law. Your name will not be used in any report. We will only use your answers after they have been combined with other respondents' answers. We believe there are no risks to you for participating in this study. There are also no direct benefits or compensation to you for participating. If you have questions about your rights, contact the UF IRB office, PO Box 112250, University of Florida, Gainesville, FL 32611.

To complete the survey please click on the link: [hyperlink]

Thank you in advance for your valuable feedback. If you feel a topic has been overlooked or not covered fully enough, please include your views in the comments section at the end of the survey so we can improve our study. Also, please feel free to contact Heather Maness with any questions or concerns at htdaniel@ufl.edu.

We look forward to receiving your responses!

Sincerely,

Ruth Francis-Floyd, DVM, MS, DACZM
Iske Larkin, PhD
Heather Maness, MS

University of Florida
PO Box 117345
Gainesville, FL 32611
352-294-2747
**First interview request e-mail sent to consenting recent graduates:**

Subject line: Follow-up to Aquatic Veterinary Medicine Survey from Univ. of Florida

Hi [name],

Thank you very much for your participation in our previous survey. I have begun analyzing the data and have some follow-up questions to identify reasons for some of the findings. Additionally, I would like to get more information on your unique experiences. You indicated on the survey that you are willing to be interviewed. The interview portion is the last phase of this research study and we are looking forward to conducting them soon so we can finish the data analysis and write-up our results for publication (we will not use your name in any report). Please let me know when in the next month would be a good time for us to meet (via an online conference) by responding to this e-mail or calling me at 352-294-2747. It is expected that the interview will take about one hour.

Your participation in this interview is voluntary. You do not have to answer any question that you do not wish to answer. However, detailed responses are most valuable for providing meaningful data. We will keep your answers confidential to the extent provided by law. Your name will not be used in any report. We believe there are no risks to you for participating in this study. There are also no direct benefits or compensation to you for participating. If you have questions about your rights, contact the UF IRB office, PO Box 112250, University of Florida, Gainesville, FL 32611.

Thank you in advance for your valuable feedback. I look forward to hearing from you!

Sincerely,

Heather

Heather Maness, MS
University of Florida
PO Box 117345
Gainesville, FL 32611
352-294-2747

---

**First reminder e-mail requesting an interview which was sent to non-respondent, consenting recent graduates:**

Subject line: Second request- Follow-up to Aquatic Veterinary Medicine Survey from Univ. of Florida

Hi [name],

I am writing to once again request your assistance with completing this study on aquatic veterinary medical education. I very much appreciate your previous participation and respectfully request that you provide us with some further information. As a reminder, I have begun analyzing the data and have some follow-up questions to identify reasons for some of the findings. Additionally, I would like to get more information on your
unique experiences. The interview portion is the last phase of this research study and we are looking forward to conducting them soon so we can finish the data analysis and write-up our results for publication (we will not use your name in any report). Please let me know when in the next month would be a good time for us to meet (via an online conference) by responding to this e-mail or calling me at 352-294-2747. It is expected that the interview will take about one hour.

Your participation in this interview is voluntary. You do not have to answer any question that you do not wish to answer. However, detailed responses are most valuable for providing meaningful data. We will keep your answers confidential to the extent provided by law. Your name will not be used in any report. We believe there are no risks to you for participating in this study. There are also no direct benefits or compensation to you for participating. If you have questions about your rights, contact the UF IRB office, PO Box 112250, University of Florida, Gainesville, FL 32611.

Thank you in advance for your valuable feedback! I look forward to hearing from you!

Sincerely,
Heather

Heather Maness, MS
University of Florida
PO Box 117345
Gainesville, FL 32611
352-294-2747

Final reminder e-mail requesting an interview which was sent to non-respondent, consenting recent graduates:

Subject line: FINAL request to please schedule the follow-up interview

Hi [name],

I have written several times to request further feedback from you on your veterinary education experience. I understand that you are busy but ask that you please respond by [date].

As a reminder, I have begun analyzing the data and have some follow-up questions to identify reasons for some of the findings as well as to get more information on your unique experiences. I very much appreciate your previous participation and respectfully request that you provide us with some further information. The interview portion is the last phase of this research study and we are looking forward to conducting them soon so we can finish the data analysis and write-up our results for publication (we will not use your name in any report). Please let me know when in the next month would be a good time for us to meet (via an online conference) by responding to this e-mail or calling me at 352-294-2747. It is expected that the interview will take about one hour.
Your participation in this interview is voluntary. You do not have to answer any question that you do not wish to answer. However, detailed responses are most valuable for providing meaningful data. We will keep your answers confidential to the extent provided by law. Your name will not be used in any report. We believe there are no risks to you for participating in this study. There are also no direct benefits or compensation to you for participating. If you have questions about your rights, contact the UF IRB office, PO Box 112250, University of Florida, Gainesville, FL 32611.

Thank you in advance for your valuable feedback! I look forward to hearing from you!

Sincerely,
Heather

Heather Maness, MS
University of Florida
PO Box 117345
Gainesville, FL 32611
352-294-2747
APPENDIX E
SEMI-STRUCTURED INTERVIEW GUIDE

Introduction statement: Thank you for taking the time to answer these follow-up questions about your experiences practicing veterinary medicine in aquatic animal health. If at any time you are unsure about what I am asking about, please stop me and ask for clarification. You do not have to answer any question that you do not wish to answer. However, full, detailed responses are most valuable to this study on educational improvements. We will record this conversation and make a transcript from it but will keep your responses confidential and secure (on the UF protected network drives) and we'll delete the recording at the conclusion of the research study. Thus, neither your name nor voice will be used in any report. Are you ready to begin or would you like to ask a question before we get started? Could you please provide a pseudonym that I can use when reporting on your responses in this research study?

1. How would you describe your level of preparedness for your AAH career?
   a. What experiences prepared you the best? Which experiences did you value most?
   b. What prevented you from being more prepared?
   c. Reference specific answers on survey for more depth on any under-developed skills.

2. What official track did you follow in your veterinary studies?
   a. Did this impact your career preparedness?

3. Did you ever take a course for DVM credit through a veterinary school other than your alma mater?

4. Please describe the lecture-based education experiences you had in vet school focusing on AAH.
   a. Were they high quality?
   b. What changes would you make, if any?
   c. Do you have any preferences between online and face-to-face learning environments or other elements of the learning environments that you experiences such as lab situations?

5. How could your DVM education in aquatic animal health be improved outside of the classroom?

6. Please describe the experiences during veterinary school that helped you develop your non-technical skills?
   a. As a whole, there was a difference between employers' views of the level of teamwork and communication skills amongst veterinarian colleagues and the self-reported skill-sets of recent graduates. Do you have any insights as to why recent graduates seem more confident in their teamwork and communication skills than employers are reporting?

7. When asked to rank applicants for a junior clinical position at your organization, you ranked (insert rankings here). Can you explain to me your reasons for this order?
8. What sort of continuing education in AAH have you engaged in, if any?
   a. Were these activities supported by your employer?
   b. Why did you not participate in a short course for CE like AquaVet, DWWF, etc?
9. What recommendations do you have for veterinary medical educators?
10. What recommendations do you have for students interested in pursuing a career in aquatic animal health?
11. Overall, how are you satisfied with your AAH career?
    a. Any unexpected outcomes from your career?
12. Is there anything else that you would like to add?
    a. Is there any other topic that you think should be addressed in this area?
LIST OF REFERENCES


Aspegren, K., & LØnberg-Madsen, P. (2005). Which basic communication skills in medicine are learnt spontaneously and which need to be taught and trained? *Medical teacher*, 27(6), 539-543.


Chun, R., Schaefer, S., Lotta, C. C., Banning, J. A., & Skochelak, S. E. (2009). Didactic and experiential training to teach communication skills: The University of
Wisconsin-Madison School of Veterinary Medicine collaborative experience. *Journal of Veterinary Medical Education, 36*(2), 196-201.


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General NAVLE® Information. (2014). Retrieved from: https://www.nbvme.org/navle-
general-information/


Lane, I., & Bogue, E. G. (2010). Faculty perspectives regarding the importance and place of nontechnical competencies in veterinary medical education at five North American colleges of veterinary medicine. Journal of the American Veterinary Medical Association, 237(1), 53-64.


Steps to becoming a veterinarian. (n.d.) Retrieved from: http://vbs.psu.edu/majors/vbs/steps-to-becoming-a-veterinarian


BIOGRAPHICAL SKETCH

Heather Maness was born and raised in Tampa, FL. She was a Girl Scout for thirteen years and earned the Gold Award as a high school senior. She received the Hillsborough Community College Honors Institute Presidential scholarship and graduated with an associate’s degree in 2003. Heather graduated from the University of Florida in 2007 with a bachelor’s degree, majoring in both wildlife ecology & conservation as well as animal sciences. She graduated, for the second time from University of Florida, in 2009 with a Master of Science in veterinary medical sciences. In 2012, she started her triple Gator pursuit, majoring in agricultural education and communication for her Doctor of Philosophy and minoring in higher education administration. Both of her graduate degrees were accomplished as she worked full-time at the University of Florida, starting at the College of Veterinary Medicine and transferring, in 2014, to Information Technology.