

Supporting Animals and Veterans through Enrichment (SAVE): An Exploratory Study on
a Brief Canine Socializing Intervention

by

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A Thesis

In

Animal Science

Submitted to the Graduate Faculty
of Texas Tech University in
Partial Fulfillment of
the Requirements for
the Degree of

MASTER OF SCIENCE

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December, 2023

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ACKNOWLEDGMENTS

I would like to thank my advisor, Dr. Anastasia Stellato, for allowing me the opportunity to work toward my master's degree under her guidance. I am thankful for your kindness and understanding, as well as the opportunities and knowledge you provided me over the course of my degree. I would also like to acknowledge my committee members, Dr. Katy Schroeder and Dr. John-Tyler Binfet, for their added support and expertise throughout this study. Additionally, I would like to thank Dr. Nathaniel Hall for his assistance and encouragement.

Furthermore, I would like to thank all of the members of the TTU Human-Animal Interaction Lab for their assistance in canine handling during the interactions, as well as their input with study development. This research could not have been made possible without assistance from Lubbock Animal Shelter and Adoption Center, TTU Military and Veteran Programs, and TTUHSC Veterans Resource Center.

Mostly, I want to thank my dad, Frederick Webberson, and my mom, Daphne Vernon, for their unconditional love and support, as well as David Lamm and Mark Mizusawa for always being there for me.

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ABSTRACT

Veterans pursuing post-secondary education face reintegration and academic-related stress. To support student well-being, post-secondary schools have begun to offer animal-assisted interventions (AAI); however, the influence of AAI on student veteran populations remains underexplored. As shelter dogs can benefit from human interaction, a mixed-methods design was used to assess if both dogs and student veterans could benefit from participating in a brief on-campus interaction. Using a 30-minute unstructured interaction between veteran students and shelter dogs, we aimed to identify whether: the interaction influenced veteran reported mood state, the dog and the interaction activities completed influenced veteran experience, and the interaction influenced shelter dog behavior. Thirty veterans ($Mage = 34$, $SD = 9.2$; 24 males, 4 females) enrolled in a Southern U.S. mid-size public university participated along with screened shelter dogs ($N = 30$, $Mage = 2$, $SD = 0.9$; 17 males, 13 females). Veterans were instructed to complete any activities of their choosing (i.e., petting, playing, talking, providing treats, brushing) with a shelter dog. To assess changes in veteran mood, a pictorial self-report scale (assessing arousal (activated, deactivated), and valence (pleasant, unpleasant)) was completed pre- and post-interaction. Dog behavior was measured in shelter before the interaction and during the beginning, middle, and end of the interaction. Results suggest a non-significant trend of veterans leaving the interaction in a pleasant deactivated mood (e.g., calm). The dog's behavior was reported to be the most memorable and to positively impact the veterans' interaction. Also, dogs entered the interaction with more behavioral displays of fear (e.g., reduced posture), general activity (e.g., jumping), and soliciting contact behaviors (e.g., soliciting play), with all behavioral activity reducing midway through the interaction. Results reveal that dogs may enter the interaction at increased fear and activity levels due to an unfamiliar human; however, their reduction in behavior suggests relaxation over the interaction. Observed decreases in dog fear behavior, veteran reported pleasant mood states and activity enjoyment suggests program benefits for shelter dogs and student veterans.

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CHAPTER I

INTRODUCTION

As animal-assisted interventions have been used to support student and veteran well-being, and human interactions have been used to promote shelter dog welfare, there may be strategies to incorporate these populations into AAI to promote their welfare. Therefore, this literature review will discuss animal-assisted interventions and the potential ways veterans and non-therapy dogs can benefit from AAI. A review of the literature will provide a basis for further research into identifying ways to support the use of AAI in benefiting both student veteran well-being and shelter dog welfare.

Animal-assisted interventions

Types, uses, and benefits

AAI has been defined as “any intervention that intentionally includes or incorporates animals as part of a therapeutic or ameliorative process or milieu” (Kruger & Serpell, 2006). This is consistently used in the literature to define various aspects of animal-assisted interventions (Fine et al., 2015), and will therefore be the definition used for the remainder of this thesis. AAI has three sub-categories, animal-assisted therapy, animal-assisted education, and animal-assisted activities which involve the utilization of animals to reach specific therapeutic or educational goals (Fine et al., 2015; Morrison, 2007; O’Haire et al., 2015).

Animal-assisted therapy (AAT) is a structured, planned, goal-oriented, and documented therapeutic approach involving the companionship of an animal directed by health and human service providers (Etheridge, 2019; Fine et al., 2015; O’Haire et al., 2015). AAT animals in therapeutic settings can help provide patients with a social buffer, a method for rapport building, a catalyst for emotion and discussion, as well as the positive benefits from exposure to the relationship between the clinician and animal (Fine, 2015). Animal-assisted education (AAE) programs are a type of educational tool used to motivate or focus students by incorporating an animal and often involves a structured time and learning goal, such as improving reading skills (Fine et al., 2015) or assisting students with developmental disabilities (Esteves & Stokes, 2008). Lastly,

animal-assisted activities (AAA), refers to an unstructured enrichment activity for people to freely interact with an unfamiliar companion animal with the expectation that the animal will provide some benefit while in their presence (Friedmann et al., 2015). For instance, AAA animals can be seen at medical care centers (Gaudet et al., 2022), affected areas of natural disaster, airports for weary travelers, and campuses for stressed students (Hart & Yamamoto, 2015).

On campus animal-assisted interventions

Organization of on-campus AAI

On campus, AAI aims to reduce stress for all students through interaction with animals, often referred to as animal visitation programs. Although animal visitation programs vary across universities, they share common characteristics. For instance, they can serve large numbers of students without strict inclusive requirements, facilitate social interaction with other students, actively dispel stigma associated with traditional therapy, and have high positive outcome expectancy (Crossman & Kazdin, 2015). The number of human participants in an intervention at one time is found to range from 1 to 5 participants and the most common ratio of dog to participant is 1:3 (Bailey, 2023). Most animal visitation programs are offered once, and the dosage of the interventions is suggested to range from 7 to 90 minutes (Bailey, 2023). However, during a three-semester long drop-in program, which included a total of 1,960 students, it is suggested that students prefer to interact with therapy dogs, on average, for 35 minutes (Binfet et al., 2018).

Benefits

It has been widely demonstrated in the literature that AAI provides benefits to students. Frequently noted benefits are reductions in stress (Binfet et al., 2018; Crossman & Kazdin, 2015; Pendry et al., 2020; Vagnoli, 2015), anxiety (Stewart et al., 2014), and depression (Kil, 2021). Research has noted significant improvements in student mood, well-being, and anxiety after a 20-minute interaction (Grajfoner et al., 2017) and a reduction in perceived stress after a short 15-minute interaction with a therapy dog (Barker et al., 2016). Some research has also demonstrated long-term benefits. For example, after a 90-minute interaction with a therapy dog, students reported immediate

benefits after the intervention (e.g., increase in happiness and energy levels, decrease in stress), and 10-hours post-interaction they reported improvement in negative affect, perceived social support, and perceived stress (Ward-Griffin et al., 2018). A scoping review of AAA offered to students also illustrated the aforementioned benefits, in addition to a reduction in homesickness, loneliness, high blood pressure, and negative affect, as well as increases in mood, connection to community, learning, self-esteem, program satisfaction, experience of love and support, creation of social relationships, and satisfaction with life (Bailey, 2023). Although there has been substantial research highlighting the benefits of AAI for college students, it has yet to be explored how these interventions can be used to help support the student veteran population.

Veterans and animal-assisted interventions

Health issues and reintegration efforts

Veterans face significant challenges including psychosocial and mental health difficulties, such as substance use disorders, post-traumatic stress, military sexual trauma, traumatic brain injury, suicidal ideation, depression (Olenick et al., 2015; Tuerk et al., 2010). Post-traumatic stress disorder (PTSD) results from witnessing or experiencing a traumatic event, and veterans have been found to experience it almost four times more than non-veterans (Olenick et al., 2015). In addition, veterans also face reintegration challenges. Reacclimating to society after deployment, including access to work, education, and reestablishing relationships, is a difficult task for veterans due to trauma and possessing non-transferable military skills (Bowling & Sherman, 2008; Olenick et al., 2015). As a result of these compounded physical and mental health challenges, veterans are a vulnerable population that could benefit from additional mental health support.

Veteran well-being

Many barriers, exacerbated by poor mental health, inhibit veterans from receiving effective treatment. These barriers are often related to conflicts with work, school, family, lack of knowledge about mental health symptoms, social stigma for seeking help, and negative beliefs against traditional therapeutic treatment (Ouimette et al., 2011; Pietrzak et al., 2009; Sayer et al., 2009). Some are turning to complementary and alternative

medicine such as massage, chiropractic care, yoga, acupuncture, hypnosis, nutritional care, and meditation (Park et al., 2016). Among these nonconventional treatment modalities, the use of AAI, interacting with service and shelter dogs and volunteering, has been demonstrated to help support veteran well-being. For instance, after several weeks of participation in equine-assisted therapy involving directed interactions or horseback riding, veterans reported a reduction in PTSD symptoms (Burton et al., 2019; Johnson et al., 2018; Lanning et al., 2017). Similarly, service dogs have been shown to provide veterans with a reduction in PTSD, anxiety, anger, sleep disturbances, and alcohol abuse (Furst, 2015; O’Haire & Rodriguez, 2018; Rodriguez et al., 2018). In addition, volunteerism affords several psychosocial benefits to veterans (Tabassum et al. 2016; Thoits & Hewitt, 2001). For instance, veterans who helped train service dogs, reported lower stress levels, and an increased sense of calm, belonging, and emotional capacity (Yount et al., 2012). Also, veterans that volunteered at a local animal shelter reported feeling good from serving the community, and kinship with animals (Linn et al., 2019). In a survey exploring the biopsychosocial outcomes of veterans who enrolled in a national civic service program, reported improvements in perceived self-efficacy, decrease in loneliness, and increase in purpose of life and perceived social support (Matthieu et al., 2016). Further, a recent study revealed the positive effects on psychological and physiological stress for veterans with PTSD after walking with a shelter dog for 30 minutes each week in one month (Krause-Parello et al., 2020). These results highlight the beneficial influence of volunteerism and shelter dogs for veterans outside of an academic setting.

Veterans often seek higher education, and in doing so, they face the same challenges as non-student veterans in addition to academic challenges (Barry et al., 2012; Borsari et al., 2017; Durdella & Kim, 2012). Furthermore, their pre-existing mental health issues can make higher education more difficult, as PTSD has been found to be negatively associated with college retention (Nyaronga & Toma, 2015) and academic performance (Barry et al., 2012; Bryan et al., 2014; Nyaronga & Toma, 2015; Rudd et al., 2011). Therefore, student veterans may receive similar, if not greater, benefits from participating in an AAI.

Animals incorporated in AAI

Welfare of animals

A variety of animals have been incorporated within AAIs, with dogs being the most incorporated animal (Fine et al., 2015). Several factors have been suggested to make dogs good candidates for AAI including their domestication, accessibility, and trainability (Nimer & Lundhal, 2007). By using a domesticated species, physical and emotional needs of the animals can more confidently be met by easily identifying, mitigating, and preventing signs of distress (Provoost, 2021). Dogs also possess certain characteristics that makes them well suited in these settings, such as their emotional and cognitive capacities, and their potential to develop significant emotional connections with humans (Bremhorst & Mills, 2021).

Emphasis has previously been placed on prioritizing humans in AAI; however, there has recently been a shift towards a One Health framework that highlights the importance of supporting the animal's health and welfare during AAI (Hediger et al., 2019; Menna et al., 2019). During these interactions, dogs can be exposed to potentially fear-eliciting stimuli, such as new people, environment and handling, and elevated sound levels. To ensure the animal's welfare, it is recommended that the animal handler is competent in understanding and identifying behavioral indicators of fear and stress so that the animal's comfort levels can be accommodated (Provoost, 2021). A review of the literature reveals inconsistent findings regarding dogs' physiological and behavioral responses to AAI, especially regarding cortisol levels (Glenk & Foltin, 2021). When assessing cortisol levels across the interactions, some studies detect cortisol levels increasing (De Carvalho et al., 2020; Haubenhofner & Kirchengast, 2006), decreasing (d'Angelo et al., 2021), and others detect no changes (Clark et al., 2020; Colussi et al., 2018; Glenk et al., 2013, 2014; Koda et al., 2015; McCullough et al., 2018; Melco et al., 2020; Ng et al., 2014; Pirrone et al., 2017). Cortisol can be non-specific, as levels can increase because of an increase in arousal, without it being negative. Behavioral parameters have been shown to provide more reliable information regarding the animal's affective state in comparison to physiological assessments and have been reliably used to assess dog welfare within AAI settings (Corsetti et al., 2019). When measuring behavior, it is important that assessments are as objective as possible and performed by trained and

unbiased individuals to prevent factors related to the individual from influencing interpretations of behavior. A standardized assessment for measuring dog behavior and welfare during AAI is therefore needed to provide more comparable and consistent findings across studies and support the implementation of welfare assessments in these programs.

Incorporating non-therapy, shelter dogs

The health and welfare of animals can be negatively impacted during their stay in animal shelters. Some factors that can impair welfare include unpredictable and novel handling, routines, sounds, sights, smells, food, conspecifics, people, and housing. These health and well-being concerns result in physiological and behavioral changes (Protopopova, 2016), such as the development of fear-related aggression, abnormal repetitive behaviors, generalized anxiety, and fear-related disorders (Beerda et al., 2000; Dalla Villa et al., 2013; Hennessy et al., 2001, Hiby et al., 2006; Titulaer et al., 2013; Tuber et al., 1999). The performance of these behaviors has been found to be associated with reduced adoption success (Protopopova et al., 2014; Titulaer et al., 2013; Wells et al., 2002).

To relieve the negative effects of sheltering, research has explored the influence of providing human interaction to shelter dogs. Most of the interactions involved petting (Bergamasco et al., 2010; Conley et al., 2014; Coppola et al., 2006; d'Angelo et al., 2021; Gácsi et al., 2001; Hennessy et al., 1997; McGowan et al., 2018; Normando et al., 2009; Popescu et al., 2018; Shiverdecker et al., 2013; Willen et al., 2017, 2019), exercising (Bergamasco et al., 2010; d'Angelo et al., 2021; Menor-Campos et al., 2011; Normando et al., 2009), playing (Bergamasco et al., 2010; Coppola et al., 2006; Menor-Campos et al., 2011; Shiverdecker et al., 2013; Willen et al., 2019), grooming (Bergamasco et al., 2010; Coppola et al., 2006; Hubrecht, 1993; Popescu et al., 2018), and training (Bergamasco et al., 2010; Coppola et al., 2006; d'Angelo et al., 2021). The duration of human interaction provided within shelter settings has been reported to range from 30 seconds to 70 minutes (d'Angelo et al., 2021; Hubrecht, 1993), with the most common being 15 to 30 minutes (McGowan et al., 2018; Normando et al., 2009, Shiverdecker et al., 2013; Willen et al., 2017, 2019). Providing shelter dogs with human interaction has

been shown to reduce indicators of fear, anxiety, aggression, and excitation-related behavioral signs (Conley et al., 2014; Shiverdecker et al., 2013; Willen et al., 2019). These interactions have also been found to increase observed relaxation (McGowan et al., 2018), affiliative behaviors displayed by shelter dogs (Gácsi et al., 2001; Hubrecht, 1993; Normando et al., 2009) and promote higher quality of life scores (Popescu et al., 2018). Additionally, when providing two 15-minute interactions per day for the first five days at a shelter, shelter dogs were less likely to display aggressive behaviors (Willen et al., 2019). Socialization is critical for shelter dogs as they experience social isolation and are more likely to respond with fear and appeasement signals toward humans rather than affiliative behaviors, thus lowering their chances of adoption (Barrera et al., 2010). Providing positive human interaction to shelter dogs can therefore promote desirable behaviors, provide socialization opportunities, reduce fearful behaviors, and increase overall welfare and adoptability.

Conclusion

This review outlined the beneficial application of AAI on college students and veterans to highlight the need for further investigation on its implementation for student veterans. This review also outlined the benefits of human interaction for shelter dogs and how this knowledge can be applied to support their inclusion in AAI. An approach to support both student veteran and shelter dog well-being using AAI will be addressed in the following chapter.

CHAPTER II

SUPPORTING ANIMALS AND VETERANS THROUGH ENRICHMENT (SAVE): AN EXPLORATORY STUDY ON A BRIEF CANINE SOCIALIZING INTERVENTION

Introduction

Animal-assisted interventions (AAI, hereafter) are programs that incorporate animals to provide alternative treatment to human participants (Kruger & Serpell, 2006). AAI programs have been implemented on university and college campuses across the United States to support students' well-being (Crossman & Kazdin, 2015). After visitation with a dog, students have been reported to experience a significant reduction in stress (Barker et al., 2016; Wood et al., 2018), homesickness (Binfet & Passmore, 2016), feelings of difficulty involving academic performance (Bailey, 2023), as well as an increase in campus connectedness (Binfet & Passmore, 2016) and positive mood levels (Crossman et al., 2015).

For individuals who have experienced trauma, AAI can provide unique therapeutic services to help manage stress levels (O'Haire et al., 2015). Specifically, AAIs are becoming more popular with military veterans and research demonstrates that time spent with animals can significantly improve veterans' quality of life (Rumayor & Thrasher, 2017). After participation in an AAI, veterans with post-traumatic stress disorder and markedly decreased well-being have been reported to experience significant clinical improvements (Burton et al., 2019; Johnson et al., 2018; Lanning et al., 2017). Also, previous research has reported increased perceptions of social support (using the Multidimensional Scale of Perceived Social Support) from volunteering (Matthieu et al., 2016) and interacting with a therapy dog after a 90-minute interaction with a therapy dog (Ward-Griffin et al., 2018). Researchers are turning to veterans in higher education and evaluating how the inclusions of animals in college student services may improve veteran health and well-being (Hertel & Abel, 2019; Kras, 2019; Pendry et al., 2020; Robino et al., 2020); consequently, there is a need to determine in what ways student veterans could benefit from an on-campus AAI.

The welfare of animals involved in AAI has recently started to be investigated. A One Health framework has been proposed, where welfare of the animals involved is considered and not compromised for the sake of human benefit (Hediger et al., 2019; Menna et al., 2019). Traditionally animals trained to provide comfort and affection have been incorporated in AAI; however, by incorporating untrained animals, such as shelter animals, there could be more opportunities available for all parties to receive benefits from the interaction. Living in a shelter can impair canine welfare (Barnard et al., 2016; Berteselli et al., 2019; Dalla Villa et al., 2013; Hewison et al., 2014; Wells, 2004) and efforts have been made to improve the shelter experience. For instance, positive human-animal interaction has been found to support shelter dog behavior and welfare (Gunter et al., 2019; Hennessy et al., 1998) and improve adoption success (Wells et al., 2002). Most interactions involve petting, exercising, playing, grooming, and training (Bergamasco et al., 2010), with the most common length being 15 to 30 minutes (McGowan et al., 2018; Normando et al., 2009, Shiverdecker et al., 2013; Willen et al., 2017, 2019). Benefits of these interactions include reduction in fear, anxiety, aggression, and excitation-related behavioral signs (Conley et al., 2014; Shiverdecker et al., 2013; Willen et al., 2019), as well as increases in relaxation (McGowan et al., 2018), affiliative behaviors (Gácsi et al., 2001; Hubrecht, 1993; Normando et al., 2009), and quality of life scores (Popescu et al., 2018).

Using a mixed-methods design, this study aims to investigate the use of an animal-assisted intervention incorporating shelter dogs on student veteran well-being and shelter dog welfare. Through providing 30-minute unstructured interactions between shelter dogs and student veterans, our objectives were to 1) determine if the interaction influences veteran reported mood state, 2) identify if factors related to the veteran, dog, and activities completed influence the veteran experience, and 3) determine if the interaction influences the behavior of shelter dogs. We hypothesize the interaction would elicit positive mood states and that mood levels reported post-interaction will be associated with previous experience with shelter dogs, previous veteran experience (e.g., veteran status length), well-being scores, perceived social support, and activities completed. We also hypothesize that shelter dogs will display fewer fear-related

behaviors across the interaction compared to in-kennel. Results from this study can be used to guide future research to support program development.

Methods

This investigation was approved by the Institutional Review Board (IRB2022-102) and by the Institutional Animal Care and Use Committee (AUP#22013).

Veteran participants

Thirty participants were recruited from a university community via hard copy recruitment flyers posted throughout campus and various city locations (e.g., pet stores, restaurants, gas stations), direct emailing through the Military of Veteran Programs office, the university's weekly email announcement system, as well as shared on social media (i.e., Facebook, Twitter). Individuals were included if they indicated on the recruitment survey that they were at least 18 years of age or older, a student at Texas Tech University, and held veteran status.

Shelter dog participants

Thirty dogs from Lubbock Animal Shelter and Adoption Center were selected to complete this study. Dogs were included if they were 8 months of age or older, up to date on vaccinations, and had no existing medical conditions. To ensure participant safety and dog welfare, dogs were excluded if they had a history of and/or presentation of fear (e.g., constant avoidance/escape attempts) or aggression (e.g., baring teeth, growling). A pool of potentially eligible dogs was identified for participation using shelter health and behavior records. Prior to data collection, research personnel verified dogs had no overt fear or aggression by measuring their willingness to approach an unfamiliar person standing at their kennel door. Dogs' willingness to approach was determined using a 5-point scale ranging from 0 (approaches readily) to 4 (does not approach; Table 1). Each approach score corresponded to the level of encouragement needed for the shelter dog to approach and for the change in position that needed to be adopted by the research personnel (e.g., standing, crouching, calling out, treat offering). To maintain animal welfare and reduce the risk to human safety, dogs with a score of 4 were not eligible to participate.

Table 1: Behavioral assessment of shelter dog willingness to approach an unfamiliar person standing outside of their kennel.

| Score | Approach Description |
|-------|---|
| 0 | Approaches front of kennel/does not leave front of kennel during assessment, and displays physical contact (pawing/jumping/leaning) with kennel door while maintaining neutral body posture and looking at researcher |
| 1 | Approaches front of kennel after a few moments of observation |
| 2 | Approaches front of kennel after researcher enters into a crouched position and calls out |
| 3 | Approaches front of kennel after researcher enters into a crouched position, calls out, and offers treats |
| 4 | Upon researcher approach, goes to/remains in far corner of kennel (or freezes in place) throughout entirety of assessment regardless of researchers attempts to encourage approach |

Procedures

Each dog-human dyad participated only once in the study, and the study included the following three phases: 1) pre-interaction assessment, 2) 30-minute unstructured interaction, 3) post-interaction assessment. All interactions took place in a research building approximately seven minutes from main campus.

Pre-interaction

To assess dog behavior in the shelter, at least one day before their scheduled interaction, each dog was video recorded for one minute in their kennel with a camera (Sony, Handycam, HDRCX405) secured on a tripod stationed outside of the kennel. The investigator stood still, off to the side during recording and avoided interacting with the dogs prior to recording to avoid biasing their behavior as much as possible. As such, approach tests occurred after video recording. Behavior was analyzed using a modified ethogram from previous research assessing dog behavior in shelter (Protopopova et al., 2014; Table 2). Shelter staff transported dogs to and from the facility using their standard transport vehicles, with the duration of transport being approximately 15 minutes each way. Upon arrival, a handler gave the dogs a brief walk around the facility before

proceeding to take them into the room where the interaction was to take place. The dog was then given a minimum of 15 minutes to acclimate to the interaction room before the participant entered the room. A handler was present during the acclimation period, and they were instructed to not interact with the dog unless necessary (e.g., prevent interference with video equipment).

Table 2: Ethogram used to identify fear-related and general activity behaviors displayed by shelter dogs in the shelter setting.

| Category Behavior | Description |
|-----------------------------------|--|
| <i>Fear-related Behaviors</i> | |
| Reduced Body Posture | |
| i. Neutral | Head normal or high, ears forward, tail high or breed specific position |
| ii. Minor | Head normal or low, ears sideways, tail lowered either still or wagging |
| iii. Major | Head low, ears down and pinned back, tail is tucked between bent hind legs |
| Lip/Snout licking | Portion of the tongue is shown and moved along the upper lip |
| Yawning | Wide opening of mouth |
| Body shaking | Lateral, side to side rotation of the body about the central axis, with shaking of the fur |
| Vocalizations | Barking, growling, whining, yelping, huffing |
| Paw lifting | Lifting one front bent leg a few inches off the ground |
| Pacing | Moving back-and-forth from the same two locations without stopping |
| Panting | Audible and/or observable breathing with mouth open and tongue exposed |
| Displacement activities | |
| i. Body-directed | Licking paws, scratching, chewing/nibbling on body |
| ii. Nosing/Sniffing | Placing nose to the ground |
| iii. Digging | Scratching the floor with forepaws, mimicking digging behavior |
| <i>General Activity Behaviors</i> | |
| Jumping | Lifting two or more legs off the ground |
| Jumping on kennel | Two or more paws make contact with the kennel door |
| Pawing at kennel door | One front paw makes contact with the kennel door (other 3 paws remain on the ground) |
| Play bowing | Lowered anterior and heightened posterior part (standing on hind legs) |

Upon participant arrival to the facility, each participant was greeted within the waiting room/entrance area and asked to complete informed consent paperwork, release documents, and an online questionnaire (Qualtrics[®], Provo, UT) available on a tablet (Windows, Surface 3). The questionnaire collected demographic information (e.g., gender, education level, age), dog ownership history, shelter dog experience and comfort level, veteran history, their likelihood to adopt or recommend adoption of a shelter dog, overall well-being (via WHO-5), perceived social support (via MSPSS), and current mood states (via Pick-A-Mood).

The WHO-5 (Table 3) is a five-item Likert-type (e.g., all of the time – at no time) self-report measure of an individual's mental well-being over the last two weeks. The WHO-5 has adequate validity in screening for depression and demonstrates good construct validity as a unidimensional scale measuring well-being in younger and elderly persons (Topp et al., 2015; WHO, 1998).

Table 3: The World Health Organization- Five Well-Being Index (WHO-5) used to assess well-being over the last two weeks.

| Over the last two weeks | All of the time | Most of the time | More than half of the time | Less than half of the time | Some of the time | At no time |
|--|-----------------|------------------|----------------------------|----------------------------|------------------|------------|
| I have felt cheerful and in good spirits | 5 | 4 | 3 | 2 | 1 | 0 |
| I have felt calm and relaxed | 5 | 4 | 3 | 2 | 1 | 0 |
| I have felt active and vigorous | 5 | 4 | 3 | 2 | 1 | 0 |
| I woke up feeling fresh and rested | 5 | 4 | 3 | 2 | 1 | 0 |
| My daily life has been filled with things that interest me | 5 | 4 | 3 | 2 | 1 | 0 |

The Multidimensional Scale of Perceived Social Support (MSPSS, Table 4) is a 12-item Likert-type (e.g., very strongly disagree – very strongly agree) self-report measure of an individual's perceived social support from family, friends, and special person. The MSPSS demonstrates good internal and test-retest reliability and moderate construct validity (Zimet et al., 1988).

Table 4: Multidimensional Scale of Perceived Social Support (MSPSS) used to assess perceived social support.

| | Very Strongly Disagree | Strongly Disagree | Disagree | Neither Agree Nor Disagree | Agree | Strongly Agree | Very Strongly Agree |
|---|------------------------|-------------------|----------|----------------------------|-------|----------------|---------------------|
| There is a special person who is around when I am in need. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| There is a special person with whom I can share joys and sorrows. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| My family really tries to help me. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| I get the emotional help & support I need from my family. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| I have a special person who is a real source of comfort to me. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| My friends really try to help me. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| I can count on my friends when things go wrong. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| I can talk about my problems with my family. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| I have friends with whom I can share my joys and sorrows. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| There is a special person in my life who cares about my feelings. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| My family is willing to help me make decisions. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| I can talk about my problems with my friends. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

The Pick-A-Mood (PAM, Figure 1) is a one-item, pictorial self-report measure developed to assess mood state (Desmet et al., 2016). The PAM displays eight mood expressions (e.g., tense, irritated, sad, bored, calm, relaxed, cheerful, excited), as well as an additional “neutral” mood state. There are three versions of the PAM including cartoon representations of a male, a female, and a robot. The robot cartoon was used for this study, as it does not indicate age, gender, or race. The construct validity (75-96% correct identification of mood states) of the PAM is appropriate for reporting mood states (Bjorn et al., 2013; Desmet et al., 2016; Zhuang et al., 2019). The Pick-A-Mood was administered as a part of the pre-interaction survey and post-interaction survey.

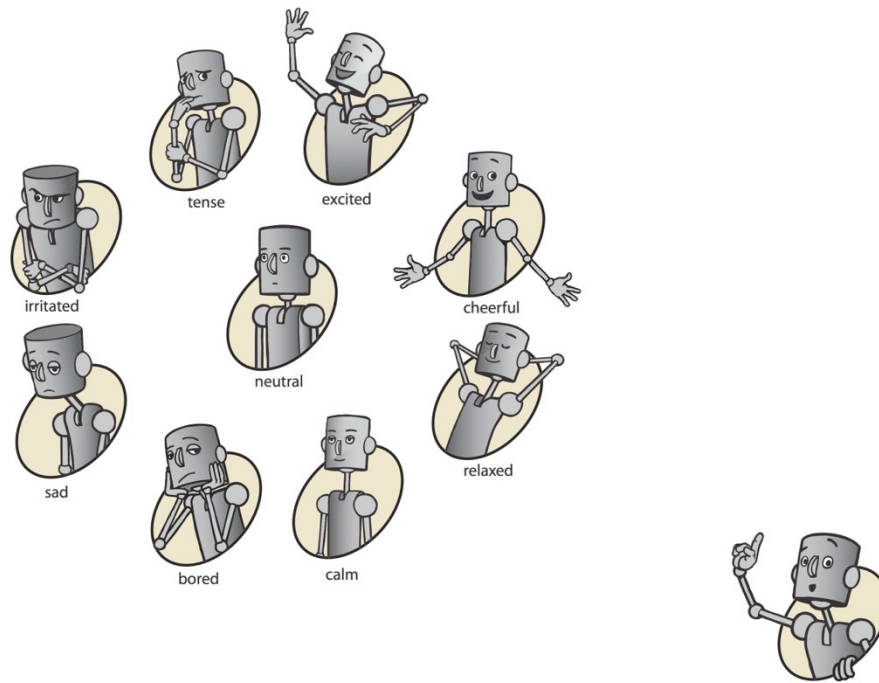


Figure 1: Pick-A-Mood (PAM). Pictorial self-report scale used to assess current mood state including valence (pleasant (excited, cheerful, relaxed, calm), unpleasant (tense, irritated, sad, bored)) and arousal (activated (irritated, tense, excited, cheerful), deactivated (sad, bored, calm, relaxed)).

After completing the questionnaire participants were then led to the interaction room to begin the 30-minute interaction.

Unstructured interaction

The interactions took place in a large observation room, with one wall being a two-way mirror. This window allowed investigators to maintain dog welfare by monitoring for any signs of distress that would warrant terminating the interaction (e.g., extreme avoidance, constant escape attempts, baring teeth, growling). The large room was divided using a partition wall to create two adjacent rooms (19.6ft x 15.8ft and 25.1ft x 12.7ft) so that two interactions could take place simultaneously; however, only one participant-dog pair was in each interaction room at a time. The interactions were video recorded using two video cameras (Sony, Handycam, HDRCX405) stationed on opposite corners of the room to record human and dog behavior. Each room was equipped with

treats, water bowl, plush, rope, and rubber toys, and dog brushes. The interaction took place on a non-slip rubber mat (8ft x 6ft) and chairs and leather couches were also provided for the participant. The leash remained on the dog for the duration of the interaction for safety purposes.

When the participant entered the room, they were instructed that they could complete any activity, in any combination, with the dog, including petting, playing, talking, providing treats, and brushing. Unstructured interactions were used to inform which activities student veterans choose and enjoy completing with the shelter dogs. The interaction began once the participant was introduced to the dog and the handler and investigator exited. Each interaction was a total of 30 minutes. This time was selected as it was the most common dosage chosen by almost 2,000 students in an on-campus AAI study (Binfet et al., 2018) and the most common duration used in AAI (Bailey, 2023). Notably, it is also one of the most common dosages reported for human interventions used to support shelter dog well-being (McGowan et al., 2018; Normando et al., 2009; Shiverdecker et al., 2013; Willen et al., 2017, 2019).

Post-interaction

After the 30-minute interaction was complete, a handler entered the room to remain with the dog until the animal shelter control officers arrived for transport, while the investigator led the participant back to the entrance area to complete the post-interaction survey. The post-questionnaire survey asked participants to report their mood using the Pick-A-Mood, their likelihood to adopt or recommend adoption of a shelter dog, and which activities (i.e., petting, brushing, playing, providing treats, talking) they enjoyed doing. They were also given Likert-type questions (e.g., strongly agree – strongly disagree) to assess whether activities conducted and certain dog-specific traits (i.e., breed, size, sex, behavior, coat color, coat type) influenced their interaction. Influence was reported as either positively influenced, negatively influenced, or no influence. They were also asked a series of open-ended questions to evaluate their thoughts on the dog's experience, their most memorable experiences, and to provide feedback regarding the interaction. To conclude their participation, each participant was thanked for their time and given a gift bag.

Data analysis

Quantitative data

All behavior was assessed using Noldus Observer XT 16 (Noldus, Wageningen, the Netherlands) and conducted by the investigator. All statistical analyses were computed in R (Version 4.3.1) and Stata Statistical Software v.17.0 (StataCorp., 131 College Station, TX, USA).

Human and dog behavior were measured using continuous sampling. Observations were two minutes in length and performed at the beginning, middle, and end of the interactions (0-2 min, 14-16 min, and 28-30 min). To determine which activities the participants completed, participant behavior was assessed using an ethogram (Table 5). These behaviors were divided into four categories: physical contact, play, vocalization, and providing treats. To assess dog behavior during the interaction, an ethogram was developed using previously established dog fear-related behaviors (Beerda et al., 1998). Behaviors were categorized as either fear-related, general activity, or soliciting contact (Table 6). In addition, dogs were assigned fear scores in-shelter and across the interaction. Fear scores were determined using subjective scoring of dog fear using a 5-point scale ranging from 0 (no fear) to 4 (extreme fear; Table 7). This scale has been reliably used in research exploring dog fear within interactions with a novel environment and person (Stellato et al., 2019, 2020). To establish intra-rater reliability, fifteen percent of the data set were randomly selected to be re-coded by the original observer, resulting in a Kappa of $k = 0.83$. This process was repeated for the in-shelter observations, resulting in a Kappa of $k = 0.94$.

Table 5: Ethogram used to identify student veteran behaviors and activities completed while interacting with a shelter dog.

| Category Behavior | Description |
|-----------------------------------|---|
| <i>Physical Contact Behaviors</i> | |
| Pet | Hand touches the dog’s body in a resting position, or repetitive back-and-forth, lateral or circular motion |
| Brush | A brush is moved along dog’s coat |
| Physical support | Allows dog to lean or rest against their body |
| Avoid | Moves dog’s body or their body away from dog’s attempts at contact |
| <i>Play Behaviors</i> | |
| Initiate play | Encourages dog to interact with a toy by manipulating or gesturing toward the toy |
| Play | Both participant and dog actively engage in play together, either with or without a toy |
| <i>Vocalization Behaviors</i> | |
| Verbal instruction | Gives dog verbal instruction in stern tone (e.g., “sit”) |
| Verbal reward | Gives dog verbal reward in engaging/high pitched tone (e.g., “good dog”) |
| Verbal correction | Gives dog a verbal behavioral correction in stern tone (e.g., “no”) |
| Verbal solicitation | Oral attempts directed at dog in an effort to obtain their attention |
| Other vocalizations | Other forms of vocalization (e.g., general speaking, humming, singing, whistling, laughing) |
| <i>Treat Behaviors</i> | |
| Treat reward | Offers ≥ 1 treat to dog |

Table 6: Ethogram used to identify fear-related, general activity, and soliciting contact behaviors displayed by shelter dogs during the unstructured interaction with a student veteran.

| Category Behavior | Description |
|-------------------------------------|---|
| <i>Fear-related Behaviors</i> | |
| Reduced Body Posture | |
| i. Neutral | Head normal or high, ears forward, tail high or breed specific position |
| ii. Minor | Head normal or low, ears sideways, tail lowered either still or wagging |
| iii. Major | Head low, ears down and pinned back, tail is tucked between bent hind legs |
| Lip/Snout licking | Portion of the tongue is shown and moved along the upper lip |
| Yawning | Wide opening of mouth |
| Body shaking | Lateral, side to side rotation of the body about the central axis, with shaking of the fur |
| Vocalizations | Barking, growling, whining, yelping, huffing, sneezing |
| Paw lifting | Lifting one front bent leg a few inches off the ground |
| Pacing | Moving back-and-forth from the same two locations without stopping |
| Panting | Audible and/or observable breathing with mouth open and tongue exposed |
| Avoiding | Manipulates their body away in response to human's actions or objects (e.g., flinching, ducking, turning, backing away, going around) |
| Displacement activities | |
| i. Body-directed | Licking paws, scratching, chewing/nibbling on body |
| ii. Nosing/Sniffing | Placing nose to the ground |
| iii. Digging | Scratching the floor with forepaws, mimicking digging behavior |
| <i>General Activity Behaviors</i> | |
| Jumping | Lifting two or more legs off the ground (non-human directed) |
| Play bowing | Lowered anterior and heightened posterior |
| <i>Soliciting Contact Behaviors</i> | |
| Soliciting contact | Approaches and attempts to initiate contact with participant |
| Soliciting play | Approaches participant with toy to initiate play |

Table 7: Fear scores used to identify level of fear displayed by shelter dogs during in-kennel observations and the beginning, middle, and end of the interaction.

| Score | Description |
|-------|---|
| 0 | Posture: <i>Head</i> normal or high, <i>Ears</i> forward, <i>Tail</i> high or breed specific position Subtle behaviours: None |
| 1 | Posture: <i>Head</i> normal or high, <i>Ears</i> forward or slightly back from neutral, <i>Tail</i> body-height or slightly lowered 1-2 subtle behaviours displayed: <input type="checkbox"/> lip-licking, <input type="checkbox"/> paw-lifting, <input type="checkbox"/> vocalizing, <input type="checkbox"/> body-shaking, <input type="checkbox"/> nosing/sniffing, <input type="checkbox"/> panting, <input type="checkbox"/> yawning, <input type="checkbox"/> body-directed, <input type="checkbox"/> pacing, <input type="checkbox"/> digging |
| 2 | Posture: <i>Head</i> normal or low, <i>Ears</i> sideways, <i>Tail</i> lowered either still or wagging Several behaviours displayed: <input type="checkbox"/> lip-licking, <input type="checkbox"/> paw-lifting, <input type="checkbox"/> vocalizing, <input type="checkbox"/> body-shaking, <input type="checkbox"/> nosing/sniffing, <input type="checkbox"/> panting, <input type="checkbox"/> yawning, <input type="checkbox"/> body-directed, <input type="checkbox"/> pacing, <input type="checkbox"/> digging |
| 3 | Posture: <i>Head</i> somewhat low, <i>Ears</i> down or slightly back, <i>Tail</i> tucked between legs Several behaviours displayed: <input type="checkbox"/> lip-licking, <input type="checkbox"/> paw-lifting, <input type="checkbox"/> vocalizing, <input type="checkbox"/> body-shaking, <input type="checkbox"/> nosing/sniffing, <input type="checkbox"/> panting, <input type="checkbox"/> yawning, <input type="checkbox"/> body-directed, <input type="checkbox"/> pacing, <input type="checkbox"/> digging |
| 4 | Posture: <i>Head</i> exaggeratedly low, <i>Ears</i> down and pinned back, <i>Tail</i> fully tucked between bent hind legs Several behaviours displayed: <input type="checkbox"/> lip-licking, <input type="checkbox"/> paw-lifting, <input type="checkbox"/> vocalizing, <input type="checkbox"/> body-shaking, <input type="checkbox"/> nosing/sniffing, <input type="checkbox"/> panting, <input type="checkbox"/> yawning, <input type="checkbox"/> body-directed, <input type="checkbox"/> pacing, <input type="checkbox"/> digging |

Dog. Given the low frequency of each behavior performed by individual dogs and the small sample size, it was not possible to analyze specific behavioral differences. Instead, the total score for the sum of all the behaviors (i.e., Fear, General Activity, Soliciting Contact) displayed was calculated for each dog. Paired t-tests were used to identify differences in the total number of behaviors displayed across the interaction and differences in the proportion of behaviors (number of behaviors performed per second) displayed in their kennel and during the interaction. Wilcoxon sign rank tests were used to identify changes in fear scores across the interaction and to identify differences in fear scores observed between in-kennel and interaction assessments. Also, a series of linear regression models were generated to determine if behaviors performed in-kennel predict behavior performed during the interaction, and if dog behavior during the beginning and the middle of the interaction predict behavior at the end.

Human. A McNemar's test was used to determine differences in reported mood states reported before and after the interaction. Using backwards selection model building, a logistic regression model was developed to identify risk factors for their post-interaction mood levels, using the combined valence and arousal states (pleasant activated vs. pleasant deactivated), with pre-interaction mood included as a covariate. Due to insufficient power, principal component analysis was used to group 20

explanatory variables into principal components. The first three principal components were tested as factors of influence in the regression model. McNemar's pairwise comparisons were used to assess the influence of dog traits on participant experience, with Bonferroni adjustments used to account for multiple comparisons. Descriptive statistics were completed to assess activity influence, activity enjoyment, and willingness to participate in a similar program.

Qualitative data

The open-ended post-interaction survey responses were analyzed using inductive qualitative content analysis (Mayring, 2014). To organize responses into meaning units, all data was prepared in Microsoft Excel (Version 16.0). In vivo coding was used to assign codes to meaning units, which were then grouped according to similarities, thus creating categories (Hsieh & Shannon, 2005).

Results

Descriptive data

A total of 30 dogs and 30 student veterans were selected and recruited for participation. Of the veterans that participated, 24 identified as male, 4 as female, and 1 as non-binary, and ages ranged from 22 to 55 years. On average, veterans reported slightly above poor well-being (59 ± 20 out of 100) in the last two weeks, and moderate perceived social support (4.8 ± 1.5 out of 7). Detailed participant information, dog experience, and service experience is provided in Table 8. All dogs (17 males, 13 females) were spayed or neutered, and the ages ranged from 8 months to 4 years. The longest stay in the shelter was approximately 10 months, while the average was four months. Nine dogs experienced their interactions while another interaction occurred simultaneously in an adjoining room. Additionally, there were no incidents of compromised canine welfare which would have warranted termination of the interaction. Although 14 of the dogs were adopted after the interaction, none were adopted by the participating veterans. Of the remaining dogs, ten were transferred and six were euthanized for aggression or failure to thrive. Demographics of the dogs are detailed in Table 9.

Table 8: Characteristics of student veteran participants.

| Veteran Information | | |
|---|----------|----------------|
| Variables | <i>n</i> | Percentage (%) |
| <i>Age</i> | | |
| 21 – 30 | 12 | 40.0 |
| 31 – 40 | 11 | 36.7 |
| 41 – 50 | 4 | 13.3 |
| 51 – 60 | 3 | 10.0 |
| <i>Ethnicity</i> | | |
| White/Caucasian | 21 | 70.0 |
| Hispanic/Latino | 6 | 20.0 |
| Asian/Pacific Islander | 1 | 3.3 |
| Prefer not to say | 1 | 3.3 |
| <i>Gender</i> | | |
| Male | 24 | 80.0 |
| Female | 4 | 13.3 |
| Non-binary | 1 | 3.3 |
| Prefer not to say | 1 | 3.3 |
| <i>Program of Study</i> | | |
| Animal Science | 5 | 16.7 |
| Psychology | 3 | 10.0 |
| History | 2 | 6.7 |
| Kinesiology | 2 | 6.7 |
| General Studies | 2 | 6.7 |
| Communication Studies | 1 | 3.3 |
| Environmental Sustainability and Natural Resources Management | 1 | 3.3 |
| Environmental Technology | 1 | 3.3 |
| Biology | 1 | 3.3 |
| Heritage and Museum Studies | 1 | 3.3 |
| Biomedical Sciences | 1 | 3.3 |
| Hospitality and Retail Management | 1 | 3.3 |
| Business Administration | 1 | 3.3 |
| Mechanical Engineering | 1 | 3.3 |

Table 8. *Continued.*

| Variables | <i>n</i> | Percentage (%) |
|--|----------|----------------|
| Music | 1 | 3.3 |
| Personal Financial Planning | 1 | 3.3 |
| Plant and Soil Science | 1 | 3.3 |
| Chemistry | 1 | 3.3 |
| University Studies | 1 | 3.3 |
| Prefer not to say | 1 | 3.3 |
| <i>Current Degree Program</i> | | |
| Bachelor's | 21 | 70.0 |
| Master's | 4 | 13.3 |
| Doctorate's | 4 | 13.3 |
| Professional | 1 | 3.3 |
| <i>WHO-5 Score</i> | | |
| Poor (≤ 50) | 9 | 30.0 |
| High (≥ 50) | 19 | 63.3 |
| <i>MSPSS Mean</i> | | |
| Low (1 – 2.9) | 3 | 10.0 |
| Moderate (3 – 5) | 14 | 46.7 |
| High (5.1 – 7) | 13 | 43.3 |
| Dog Experience | | |
| <i>Number of Currently Owned Dogs</i> | | |
| 0 | 14 | 46.7 |
| 1 | 9 | 30.0 |
| 2 | 2 | 6.7 |
| ≥ 3 | 5 | 16.7 |
| <i>Number of Current and Previously Owned Dogs</i> | | |
| 0 – 5 | 22 | 73.3 |
| 6 – 10 | 4 | 13.3 |
| 11 – 15 | 3 | 10.0 |
| ≥ 20 | 1 | 3.3 |

Table 8. Continued.

| Variables | <i>n</i> | Percentage (%) |
|---|----------|----------------|
| <i>Dog Source for Current and Previously Owned Dogs</i> | | |
| Rescue/Shelter | 14 | 46.7 |
| Family/Friend | 11 | 36.7 |
| Advertisement | 6 | 20.0 |
| Stray | 6 | 20.0 |
| Pet Store | 1 | 3.3 |
| None | 3 | 10.0 |
| <i>Service Dog Ownership</i> | | |
| Yes | 2 | 6.7 |
| No | 28 | 93.3 |
| <i>Experience with Shelter Dogs</i> | | |
| None | 10 | 33.3 |
| Less than 6 months | 11 | 36.7 |
| 6 months – 1 year | 3 | 10.0 |
| 2-5 years | 6 | 20.0 |
| <i>Comfort Level with Shelter Dogs</i> | | |
| Very comfortable/relaxed | 19 | 63.3 |
| Comfortable | 7 | 23.3 |
| Neutral | 4 | 13.3 |
| <i>Likelihood to Adopt Pre-Interaction</i> | | |
| Extremely likely | 20 | 66.7 |
| Likely | 7 | 23.3 |
| Neutral | 3 | 10.0 |
| <i>Likelihood to Adopt Post-Interaction</i> | | |
| Extremely likely | 23 | 76.7 |
| Likely | 4 | 13.3 |
| Neutral | 3 | 10.0 |
| Veteran Experience | | |
| <i>Veteran Status Length</i> | | |
| Less than 6 months | 2 | 6.7 |
| 6 months – 1 year | 5 | 16.7 |
| 2-5 years | 10 | 33.3 |

Table 8. Continued.

| Variables | <i>n</i> | Percentage (%) |
|----------------------------------|----------|----------------|
| 6-10 years | 6 | 20.0 |
| ≥ 11 years | 7 | 23.3 |
| <i>Number of Times Deployed</i> | | |
| 1 | 7 | 23.3 |
| 2 | 5 | 16.7 |
| 3 | 3 | 10.0 |
| 4 | 1 | 3.3 |
| 14 | 1 | 3.3 |
| Never deployed | 13 | 43.3 |
| <i>Combat or Warzone Service</i> | | |
| Yes | 14 | 46.7 |
| No | 15 | 50.0 |
| Prefer not to say | 1 | 3.3 |
| <i>Branch</i> | | |
| Army | 16 | 53.3 |
| Navy | 5 | 16.7 |
| Marine | 5 | 16.7 |
| Reserves | 5 | 16.7 |
| Air | 4 | 13.3 |
| National | 4 | 13.3 |
| Coast | 1 | 3.3 |
| <i>Length of Service</i> | | |
| 2 – 5 years | 14 | 46.7 |
| 6 – 9 years | 8 | 26.7 |
| 10 – 13 years | 4 | 13.3 |
| 14 – 17 years | 1 | 3.3 |
| 18 – 21 years | 2 | 6.7 |

Table 9: Characteristics of shelter dog participants.

| Variables | <i>n</i> | Percentage (%) |
|-----------------------|----------|----------------|
| <i>Age</i> | | |
| ≤ 1 year | 9 | 30.0 |
| 2 years | 14 | 46.7 |
| 3 years | 5 | 16.7 |
| 4 years | 2 | 6.7 |
| <i>Sex</i> | | |
| Male | 17 | 56.7 |
| Female | 13 | 43.3 |
| <i>Breed</i> | | |
| Pitbull | 21 | 70.0 |
| Retrievers | 3 | 10.0 |
| Shepherds | 2 | 6.7 |
| Rottweiler | 1 | 3.3 |
| Hound | 1 | 3.3 |
| Cattle Dog | 1 | 3.3 |
| Mixed | 1 | 3.3 |
| <i>Length of Stay</i> | | |
| 1 – 3 months | 11 | 36.7 |
| 4 – 6 months | 16 | 53.3 |
| ≥ 7 months | 3 | 10.0 |
| <i>Kennel Mate</i> | | |
| Yes | 28 | 93.3 |
| No | 2 | 6.7 |
| <i>Approach Score</i> | | |
| 0 | 21 | 70.0 |
| 1 | 4 | 13.3 |
| 2 | 4 | 13.3 |
| 3 | 1 | 3.3 |
| <i>Outcome</i> | | |
| Adopted | 14 | 46.7 |
| Transferred | 10 | 33.3 |
| Euthanized | 6 | 20.0 |

Dog behavior

When assessing the performance of fear-related behaviors in shelter dogs across the interaction, results reveal more fear behaviors (mean \pm SE) being performed during the first two-minutes (16.1 ± 2.03) of the interaction compared to the middle (8.03 ± 1.13 ; $p = 0.001$) and end (8.6 ± 1.26 ; $p = 0.002$), with no difference in performance between the middle and end of the interaction ($p = 0.69$). Results from the fear scores present a similar story, as higher fear scores (mean \pm SE) were observed during the first two minutes (2.63 ± 0.18) of the interaction compared to the middle (1.93 ± 0.19 ; $p = 0.0005$) and end (1.83 ± 0.14 ; $p = 0.0008$), with no difference in fear scores between the middle and end of the interaction ($p = 0.89$; Figure 2).

When comparing the performance of fear-related behaviors performed during the interaction to in-kennel assessments, results suggest that during the first two minutes of the interaction there was more fear behaviors displayed per second (0.13 ± 0.017 ; $p = 0.028$) and higher fear scores observed ($p = 0.0045$) compared to in-kennel (Fear behaviors: 0.08 ± 0.01 ; Fear Score: 1.87 ± 0.12). There was no difference in performance of fear-related behaviors in-kennel between the middle ($p = 0.43$) and end of the interaction ($p = 0.59$) or fear scores observed in-kennel between the middle ($p = 0.92$) and end of the interaction ($p = 0.73$).

Further, during the first two minutes there was more general activity (2.1 ± 0.86 ; $p = 0.03$; Figure 3) and soliciting contact behaviors (3.8 ± 0.83 ; $p = 0.007$) compared to the last two minutes (General activity: 0.23 ± 0.10 ; Soliciting contact: 1.4 ± 0.39). There was no difference between general activity and soliciting contact behaviors performed during the beginning and middle of the interaction (General activity: $p = 0.09$; Soliciting contact: $p = 0.06$) or between the middle and end of the interaction (General activity: $p = 0.24$; Soliciting contact: $p = 0.34$; Figure 3). There was also no difference between general activity behaviors performed in-kennel compared to the beginning ($p = 0.84$), middle ($p = 0.13$), and end of the interaction ($p = 0.06$). Additionally, regression results reveal dogs were more likely to display general activity behaviors at the end of the interaction if they performed these behaviors during the beginning ($p = 0.009$).

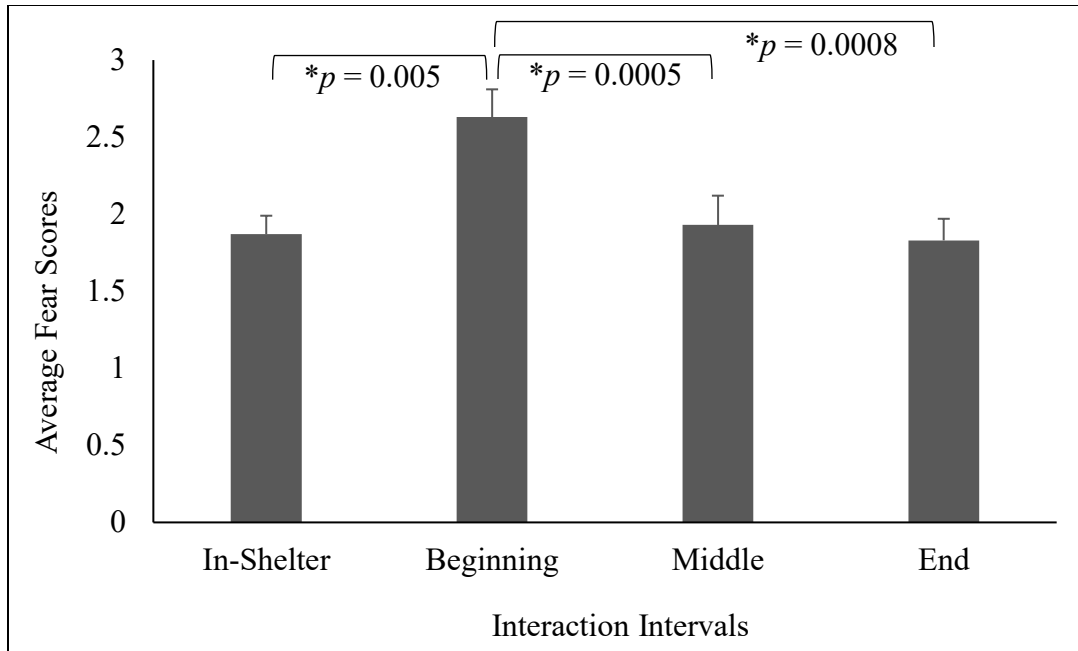


Figure 2: Average fear scores displayed by dogs while in-kennel and during the beginning, middle, and end of the interaction.

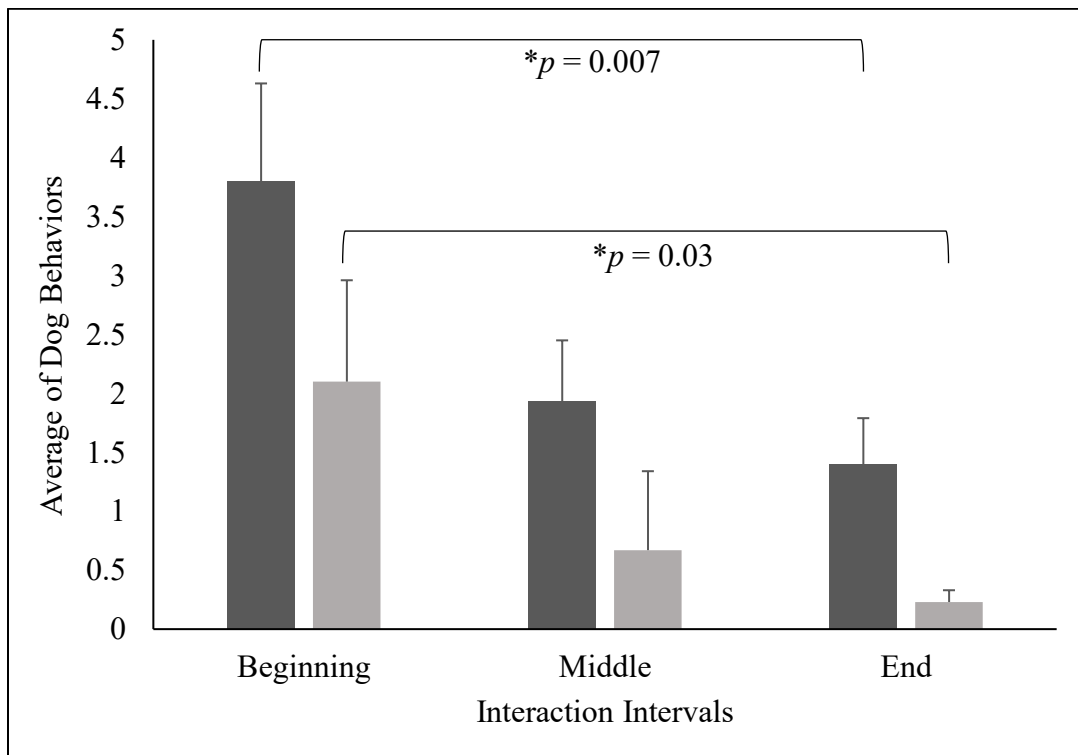


Figure 3: Average number of non-fear-related behaviors, including soliciting contact (dark grey), and general activity (light grey), displayed by shelter dogs during the interaction.

Veteran reports

Quantitative data

Human mood state. When veterans reported their mood using the Pick-A-Mood before the interaction, 40% (12/30) indicated pleasant deactivated mood states, 33.3% (10/30) indicated pleasant activated, 16.7% (5/30) indicated neutral, 6.7% (2/30) indicated unpleasant activated, and 3.3% (1/30) indicated unpleasant deactivated. Post-interaction, 53.3% (16/30) indicated pleasant deactivated, 43.3% (13/30) indicated pleasant activated, and 3.3% (1/30) indicated neutral, with no participants reporting unpleasant moods. Results reveal no significant differences between mood states reported before and after the interaction ($p = 0.53$); however, there was an observed trend for veterans to report a pleasant deactivated mood post-interaction ($n = 16$; Table 10). Descriptive statistics reveal that all participating veterans are willing to participate in a similar program in the future.

Table 10: Mood states reported by student veterans using the Pick-A-Mood before and after the interaction.

| Pre-Interaction Mood | Post-Interaction Mood | | | Total |
|------------------------|-----------------------|--------------------|----------------------|-------|
| | Neutral | Pleasant Activated | Pleasant Deactivated | |
| Neutral | 0 | 1 | 4 | 5 |
| Pleasant Activated | 0 | 6 | 4 | 10 |
| Pleasant Deactivated | 0 | 6 | 6 | 12 |
| Unpleasant Activated | 1 | 0 | 1 | 2 |
| Unpleasant Deactivated | 0 | 0 | 1 | 1 |
| Total | 1 | 13 | 16 | 30 |

Results from the logistic regression reveal that veteran reported mood post-interaction was associated with principal component three from the principal component analysis ($p = 0.02$). Eight factors were included in this principal component; four were related to the veterans' experiences with dogs (number of currently owned dogs, number of owned dogs throughout life, likelihood to adopt a shelter dog, and previous experience with shelter dogs), three were demographic related (age, length of holding veteran status, and their MSPSS score), and the last factor was related to whether they believed the activities influenced their interaction. Mood states reported pre-interaction was not a significant predictor of post-interaction mood ($p = 0.44$).

Activity influence and enjoyment. Descriptive statistics indicate that most veterans strongly agree (63.3%, 19/30) or somewhat agree (30%, 9/30) that the activities completed influenced their experience with the dog. All participants reported petting and talking with the dogs, and the majority reported providing treats (90%, 27/30) and playing (79%, 23/29), while the least completed activity was brushing (55%, 16/29; Figure 4). Results from behavioral observations across the beginning, middle, and end of the interaction mirror their reported data, as the most observed activity was talking (13.8 ± 8.2) and the least observed was brushing (2.2 ± 1.4). For those that indicated completing these activities, all participants reported enjoyment and only one participant reported they did not enjoy talking to the dog. The most enjoyed activity was providing treats (100%, 27/27), followed by petting (97%, 29/30).

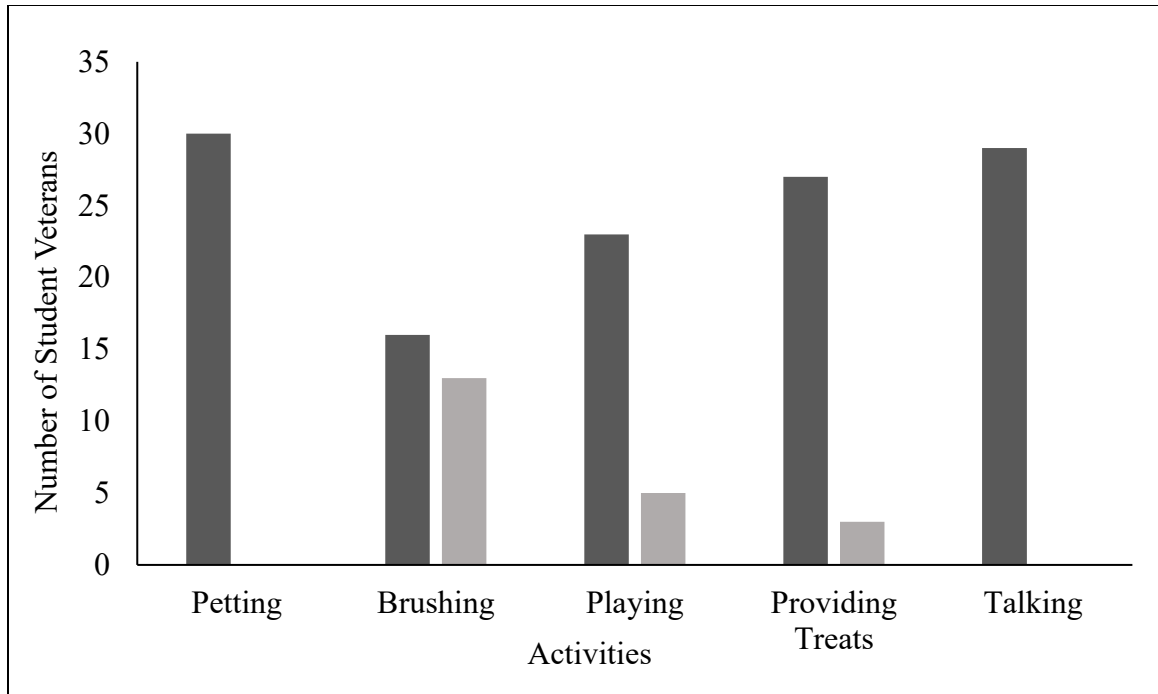


Figure 4: Number of student veterans ($n = 30$) who reported completing (dark grey) or not completing (light grey) each activity with a shelter dog during the unstructured interaction.

Dog traits. Descriptive statistics show that dog traits (i.e., behavior, breed, size, sex, coat color, coat type) either had no impact or a positive impact on how the veterans felt about their experience, with only two participants reporting that the size of the dog and type of coat negatively influenced their interaction (93%, 28/30). Among the traits that were reported to positively influence their experience, most veterans reported dog behavior (73%, 22/30), with the least reported traits being the sex of the dog (33%, 10/30) and coat color (34%, 10/29). Based on pairwise comparisons, dog behavior was reported to influence their interaction more than coat color ($p = 0.0034$) and sex of the dog ($p = 0.0018$), and the size of the dog was reported to influence their interaction more than the sex of the dog ($p = 0.0039$).

Qualitative data

Question 1.

All participants ($n = 30$) answered the first open-ended question in the post-interaction survey which asked, “How do you believe the dog felt about interacting with you?”. The qualitative content analysis produced a total of 30 meaning units and three categories

which were: *Mixed Feelings or Uncertainty about Interacting*, *Positive Feelings about Interacting*, and *Fearful Feelings about Interacting*.

Mixed Feelings or Uncertainty about Interacting. This category had 13 meaning units and consisted of participants reporting interpretations of the dogs' feelings as mixed or uncertain using adjectives such as, "confused", "unsure", "timid," and "shy". These descriptions would sometimes exhibit a change in behavior throughout the interaction. For example, "Unsure at first, but then relaxed", and "A tad shy at first then opened up to being happy." However, some descriptions depicted mixed feelings occurring simultaneously, for example, "She seemed nervous and skittish, but seemed to like being pet" and "Overwhelmed but happy."

Positive Feelings about Interacting. This second category included 12 meaning units that described participants' perceptions of the dogs having positive experiences during the interaction. This category consisted of participants which reported their interpretations of the dogs' emotional states as positive, using descriptors such as, "excited" and "happy". For example, "He seemed happy" and "Shadow seemed excited to have an outside the shelter interaction." This category also included a few responses which relayed dog behavior that could be interpreted as positive, for example, "He is attentive and playful" and "I think the dog felt good interacting with me. The dog wanted to be close to me almost all the time, sat in my lap, allowed me to pet its belly and touch/hold its paws."

Fearful Feelings about Interacting. The final category comprised of 5 meaning units that indicated the participants' perceptions that the dogs were displaying fearful feelings during their interactions. In this category, participants gave descriptions of the dogs' displaying emotions related to fear, but no specific fear behaviors were reported. Examples of this were, "distrustful but trying to trust" or simply, "scared" or "nervous."

Question 2.

All participants ($n = 30$) answered the second open-ended question in the post-interaction survey which asked, "What was the most memorable part(s) of your interaction with the dog today?". It was specified that this could be a positive or negative moment.

Additionally, there were prompts to guide participants to elaborate on what aspects of the

interaction were most memorable, including, “What activity/activities were you doing?”, “What was the dog doing that made the activity/activities memorable for you?”, and “Did anything surprise you about the dog or activity?”. The qualitative content analysis produced a total of 30 meaning units and three categories which were: *Dog’s Reactions to the Activities*, *Completing Activities with the Dog*, and *Dog’s Positive Personality Traits*.

Dog’s Reactions to the Activities. The first category indicated that the most memorable part of the interaction was the dogs’ reactions to the participant activities. This category had 19 meaning units which described a range of reactions as either emotions or behaviors in response to an activity. In this category, the participants’ most memorable part was solely the dogs’ reactions, not the activity. An example of a perceived emotional response was, “She stayed calm while I pet her. She did not seem to like the sound of the squeaky toy”, while a behavioral response was, “Immediate tail wags when I sat with her and of course, gave her treats.”

Completing Activities with the Dog. The second category consisted of 7 meaning units in which participants indicated that the activities they completed with the dogs were the most memorable part of the interaction. In contrast to the last category, the participants indicated that the most memorable part was the activities they chose to complete, not the dogs’ reactions to those activities. The activities mentioned included brushing, providing treats, playing, gaining trust, cleaning, and preventing the dog from knocking down objects; however, the most mentioned activity completed was petting. For example, one participant stated, “Sitting and cuddling with Enchilada and brushing him was enjoyable”, while another said, “being able to play and pet the dog”.

Dog’s Positive Personality Traits. The last category described participants’ reports of the dogs’ positive personality traits and comprised of 4 meaning units. Two personality traits, even-tempered and amiable, were most evident in participant responses, as demonstrated by descriptors such as, “not agitated”, “calm”, “not overly excited”, “non-aggressive”, “chill”, “loving”, “friendly”, and “sweet”. An example report was, “Blake was very chill. Not overly excited. Very calm and loving.”

Question 3.

70% of participants ($n = 21$) answered the last open-ended question, “Please provide any feedback you have regarding program participation.”, while 30% ($n = 9$) indicated no feedback. The qualitative content analysis produced a total of 21 meaning units and two categories which were: *Positive Feedback* and *Constructive Feedback*.

Positive Feedback. This category is comprised of 12 meaning units and described participants’ positive feedback regarding the program. Within this category, positive feedback could be regarding the interaction design or the interaction experience. An example of positive interaction design was, “The process was straightforward and easy to complete”, while an example of positive experience was, “I thoroughly enjoyed participating in the program.”

Constructive Feedback. This second category consisted of 9 meaning units and described participant feedback with suggestions on how the program can be improved. This category had constructive feedback regarding the interaction and survey design. Suggestions included adding more participants and dogs, as well as allowing multiple visits; however, the most common suggestion was to include outdoor access, for example one participant noted, “Would love to interact with the dogs in an open area with a fence, see if they want to play outside.”

Discussion

Results from the current study suggest that across the unstructured interaction between shelter dogs and student veterans, dogs displayed a reduction in fear and student veterans reported pleasant mood states and activity enjoyment. Student veterans also reported they had an overall positive experience and that the most memorable part was the dogs’ reactions to the activities. Furthermore, although the student veterans did not adopt the dogs they interacted with, a majority of them indicated that they would recommend adopting a shelter dog to other potential adopters, therefore enhancing the visibility of the shelter dogs incorporated into AAI.

Dog behavior

Dog behavioral assessments suggest that dogs entered the interaction with a greater display of fear, general activity, and soliciting contact behaviors, and midway through the interaction all behavioral activity reduced. It is possible that dogs entered the interaction with higher arousal levels because of the unfamiliar person entering the room and beginning to engage with them, and as the dog familiarized themselves with the veteran, their arousal levels reduced as a result. To mitigate initial fear levels caused by the presence of an unfamiliar person entering the room, it is worth considering the possibility of having the participant greet the dog outside the room and then entering the interaction space together. Further, the decrease in behavioral activity from the beginning to the end of the interaction may suggest dogs became calm as the interaction progressed. This idea is supported by a study which reported a decrease in the frequency of shelter dogs soliciting contact and a decrease in duration of standing after a 15-minute interaction, which is associated with a positive state of relaxation (McGowan et al., 2018). Similar results were presented in previous research exploring the influence of a 30-minute human interaction with shelter dogs, as they detected a reduction of excitement and fear behaviors after the interaction was completed (Shiverdecker et al., 2013). These studies exemplify that interactions can elicit positive and negative arousal in the beginning that diminishes after a period of familiarization.

In addition, results suggest that dogs' in-kennel behavior does not predict behavior within the interaction; however, general activity (i.e., jumping, play bowing) performed at the beginning of interaction predicted their behavior at the end of the interaction. This could be used to predict how dogs might behave during an interaction, thus supporting proper selection of shelter dogs for inclusion in future interactions. Though fear has been suggested to be a temperament trait that is consistent over the dog's lifespan (Adolphs, 2013), the level of fear observed in dogs in the shelter does not predict their fear experienced during an interaction with an unfamiliar human outside of the shelter. This is similar to previous research that demonstrates the specificity of in-shelter behavior assessments and how the behaviors performed in the shelter environment do not accurately represent how dogs will behave outside of the shelter (Patronek & Bradley, 2016). As most dogs received an approach score of zero (i.e., approaches readily) when

in shelter, it is likely the nature of engaging with an unfamiliar human in a novel environment is what elicited a change in their behavior during the interaction. Thus, to mitigate fear responses associated with interacting with an unfamiliar person and/or certain activities, an in-depth behavioral evaluation can be performed during the animal selection process. These behavioral evaluations can involve ‘mock’ interactions where the investigator attempts to engage the dog in activities (e.g., playing, petting, talking, grooming, providing treats) outside of the kennel environment (e.g., shelter play yard) to give a more detailed description to student participants regarding dog sociability levels and how best to interact with them.

When assessing dog fear during the interaction, similar results were detected from using the 5-point scale and from using the sum of all the fear behaviors displayed. Thus, the cross-validation of the scale suggests that counting the occurrence of each behavior is not needed, and rather a faster, subjective scoring system can be used to assess dog behavior and welfare during an AAI. This scoring system has been used by trained experts in animal behavior and welfare and dog owners to assess dog fear within veterinary clinic settings (Stellato et al., 2019a, 2019b, 2020), and can be used to assess a dog’s fear in response to novel environments, people, and handling. Future research should explore the reliability and validation of using this scoring system of fear in other AAI settings.

Veteran reports

While differences were not detected between veteran reported mood states before and after the interaction, there was a trend in veterans leaving the interaction in a pleasant deactivated mood. They reported feeling relaxed, cheerful, or calm post-interaction rather than bored, sad, or irritated. These findings are supported by previous research, where on-campus AAI was found to provide increased reports of happiness (Dell et al., 2015; Ward-Griffin et al., 2018) and improvements in student mood and well-being (Grajfoner et al., 2017; Bailey, 2023), indicating that AAI can illicit positive mood states. Notably, student veterans received these similar benefits, even though the present study did not offer a standard, professional session as used in most on-campus AAI studies. Factors related to veteran reported mood after the interaction were veteran age, length of veteran

status, MSPSS score, number of currently owned dogs, number of owned dogs throughout life, likelihood to adopt a shelter dog, how the activities influenced their interaction, and previous experience with shelter dogs. While results provide insights into the relationship between the principal component factors and post-interaction mood, the magnitude and direction of the effect of each factor warrants further investigation. These results therefore highlight the need for further research to identify which factors best predict mood levels after participating in an AAI. It could be particularly valuable to identify if previous dog experiences have an impact on future interactions with dogs, as this could help guide the types of interactions (e.g., number of dogs, behaviors/energy level of dogs) that veterans could be more receptive to. Also, as most veterans reported a moderate level of perceived social support, further research should identify if veterans experience a more significant change in mood after the interaction if they have a low or high level of perceived social support.

When assessing program feedback after the interaction, most veterans reported that the activities they completed with the dogs during the interaction influenced their experience and that certain shelter dog traits had either positive or no impact on their experience. Qualitative content analysis revealed that most student veterans felt as if the dog was unsure about the interaction. They stated that the dogs displayed feelings of being "...half into me...", "confused...", "tentative...", and "...opened up as I gained her trust." These reports could be reminiscent of the beginning of the interaction when the dogs were showing the most fearful behaviors. It is also possible that the mood of the veteran biased their perceptions. For instance, in one study that explored the use of AAI for prisoners, the handlers' mood (e.g., arousal) skewed their perception of dog behaviors, such that they reported the dogs' stress levels to mirror their own increased stress (Koda et al., 2015). Future research should further explore the relationship between participant mood levels and their assessments of dog behavior during on-campus AAI. The most enjoyable activities reported by the veterans were providing treats and petting, thus it may be beneficial to include a positive reinforcement training component to these interactions where shelter dogs can receive added positive human interactions through cognitive enrichment and advanced behavioral support. Student veterans stated that their most memorable moments from the interaction were the dog's responses to the activities.

For example, some knew tricks, “He knew how to sit with hand gestures. pleasant surprise”, while others enjoyed relaxing with the veterans, “The dog was very sweet and layed on me”, or eating treats, “When she took a treat out of my hand.”

As seen in both qualitative and quantitative analysis, the dog’s behavior had the most positive impact on the interaction, while the dog’s size and coat type had the most negative. The current sample of dogs was predominately Pitbull breeds, as such the incorporation of a more diverse sample of dog breeds (e.g., breeds with a longer coat or smaller size) may be preferred. Future research should detail the specific types of behaviors, sizes, and coat types that are preferred by student veterans so specific inclusion criteria for shelter dogs can be used to create the most positive interactions.

When asked to provide feedback regarding the program, student veterans responded with positive and constructive feedback. The most commonly reported constructive feedback was regarding incorporating an outdoor component of the interaction. This could be beneficial for both dogs and participants by allowing more space and enrichment opportunities for play. Additional feedback involved the inclusion of more participants. Future research should explore the socialization benefits of including fellow student veterans, while remaining vigilant of the potential added stressors this could create for the shelter dogs. By understanding student veteran preferences in activities and which dogs to include in future programs, these findings can inform future research regarding on-campus AAI for student veterans. Overall, all participating veterans indicated that they would participate in a similar program in the future.

Limitations

Research of this nature is complicated to conduct when considering the laboratory setting, as well as the variety and number of stakeholders involved (e.g., student veterans, shelter staff, shelter dogs, research personnel). One of the main limitations was the sample size. Due to insufficient power, we were not able to detect changes in mood or which specific factors influenced reported mood levels after the interaction. As similarly observed in other research (Bailey et al., 2014; Resio et al., 2004), the veteran population is a challenging population to recruit for research. To counteract these challenges, we

combined multiple efforts including social media, online and paper recruitment flyers dispersed across the university and surrounding community, direct emailing and in-person conversations through the Military and Veteran Programs office, providing incentives (i.e., \$10 Starbucks gift card), as well as, extending the recruitment period an additional three months. The location of the study being off main campus may have negatively influenced recruitment efforts; however, the research facility was optimal to perform and safely observe human-animal interactions and it was accessible using the campus bus. The two interaction rooms were separated by a removable partition, thus indicators of another dog in the adjoining room could be easily sensed by each of the nine dogs that experienced a simultaneous interaction. In response to this, our inclusion criteria for the dogs explicitly omitted dogs with dog directed aggression, therefore any awareness of another dog likely resulted in mere distraction or interest. In addition, though our human participants were predominately male, this is an accurate representation of the student veteran population (Baechtold & Sawal, 2009). Our dog population was predominately Pitbull and two years old, yet this is representative of the general population of the dogs in the local shelter that partnered with this study. As with any self-report survey, the current results may be susceptible to social desirability bias, and this was mitigated as much as possible by assuring anonymity in responses.

To inform program development, unstructured interactions were implemented so that the activities student veterans chose to complete and enjoyed could be assessed. As a result, each veteran-dog interaction was unique and more direct comparisons of dog behavior were not able to be made between interactions, especially in response to activities completed. Continuous sampling across the entire 30-minute interaction was not used, as such, dog behavior and human activities were only recorded during set intervals across the interaction. As a result, we are unable to affirm animal and human behavior between these intervals. Our primary aim was to discern how shelter dog behavior changed during the interaction, rather than providing a comprehensive overview of the entire interaction. Thus, this selective behavior coding methodology was chosen to capture snapshots of the interaction and has been effectively used in similar research (McGowan et al., 2018).

CHAPTER III

CONCLUSION

Animal-assisted interventions are growing in popularity in academic settings for students struggling with homesickness and stress (Bailey, 2023). Student veterans suffer from compounded stressors from reintegration and academic life (Borsari et al., 2017). Although, benefits have been found for both students and veterans, this study is the first to identify potential well-being effects for student veterans specifically. Similarly, although the welfare of therapy dogs in AAI has been measured (Glenk & Foltin, 2021) and shelter dogs have benefited from brief human interaction (Shiverdecker et al., 2013), no studies have previously analyzed the possible well-being implications from incorporating shelter dogs into AAI.

The results of this research suggest that student veterans can benefit from AAI. Although we potentially encountered ceiling effects in relation to mood states, veterans did not report feeling bored, sad, irritated, or tense after their interaction with the dog, but instead reported feeling relaxed, cheerful, or calm. Another indicator of a positive experience were their reports of enjoyment from completing the activities with the dogs. Qualitatively, the student veterans stated that the dog's reactions were the most memorable part of the interaction, and though they provided insightful program feedback all participants reported willingness to participate again.

Furthermore, the study implies that shelter dogs could benefit from being incorporated in an on-campus AAI. Although there was an increase in fear displayed at the beginning of the interaction, there was a significant decrease over the course of the interaction. The reduction in all behavioral activity across the interaction suggests that the shelter dogs experienced lower arousal levels (e.g., became calmer) as the interaction progressed. Thus, incorporating non-therapy shelter dogs in on-campus animal assisted interventions can provide positive socialization experiences, and enhanced visibility to support adoption success.

Overall, this research shows the potential well-being effects for student veterans and shelter dogs. Although our findings reveal a positive outcome for both populations,

specific factors involved in the interaction warrant further exploration. In the context of animal-assisted interventions (AAI), future research should aim to optimize the interaction between student veterans and shelter dogs. This involves considering various demographics and experiences to determine which participants might receive the greatest benefits from the interaction. Furthermore, we propose using this information to carefully pair participants, aiming to create interactions that are mutually beneficial. Additionally, our research suggests tailoring specific activities based on individual preferences and socialization needs of the dogs involved. We also plan to investigate the impact of the interaction location, exploring whether offering it on the main campus enhances the potential benefits and visibility to boost participation. To strengthen the validity of our findings and facilitate generalization, we advocate for a larger sample size. This not only supports the creation of a standardized program but also enhances the applicability of our results to other university campuses. While our present study has uncovered evidence of the positive effects AAI can have for both student veterans and shelter dogs, we acknowledge the need for further research. Identifying the most influential factors is crucial for the future of AAI, and our study lays the groundwork for future investigations in this area.

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