

# To touch or not to touch, does it make a difference?

Is there evidence to support the claim that using animal-visitor interactions in formal zoo education programs increases uptake of pro-environmental behaviours?

Tarryn Basden

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## List of Acronyms

AVI – Animal-visitor interaction

PEB – Pro-environmental behaviour

### **Zoo Accrediting Bodies**

AZA – Association of Zoos and Aquariums (America)

WAZA – World Association of Zoos and Aquariums

ZAA – Zoo and Aquarium Association (Australia)

# 1. Introduction

With more than 700 million visitors every year, zoos and aquariums are in a unique position to inspire their visitors to care about animals both in zoos and the wild (World Association of Zoos and Aquariums, 2015). Many formal zoo and aquarium education programs (here defined as pre-booked, educational presentations for students) use animal-visitor interactions (AVIs) in order to better engage their audience, while also claiming they improve learning outcomes and increase uptake in pro-environmental behaviours (Godinez & Fernandez, 2019; Povey & Rios, 2002). It is often claimed that AVIs increase feelings of connectedness with animals and nature, and increase willingness to undertake pro-environmental behaviours in human participants (Spooner et al., 2021). However, evidence to support these claims appears to be ambiguous at best. While there is evidence to show that audiences are more likely to be engaged when their emotions and senses are engaged (Visscher et al., 2009), this research does not specifically address the use of AVIs to achieve these outcomes.

Within a zoo or aquarium context, there is myriad research on;

- the effectiveness of zoo and aquarium education programs in increasing pro-environmental behaviours (Moss & Esson, 2013; Ogden & Heimlich, 2009; Routman et al., 2022);
- the impact of AVIs on animal welfare (8,9);
- the impact of public AVIs on increasing pro-environmental behaviours (Clifford-Clarke et al., 2021; C. K. Collins et al., 2021; Swanagan, 2000).

But there appears to be little research into whether using AVIs in *formal* zoo and aquarium education programs improves uptake in pro-environmental behaviours. If we are to be using best practice science communication methods in zoo and aquarium education programs, we first need to know whether the techniques we currently use are truly effective.

This mapping review seeks to establish what the current research says about the effect of AVIs on human participants, while identifying the gaps in research that need to be filled before we can truly claim that AVIs in formal zoo and aquarium education programs help to increase pro-environmental behaviours.

## 1.1 Background

### 1.1.1 Purpose of Zoos

Zoos and aquariums are historically defined as “a place where live animals are kept, studied, bred, and exhibited to the public” (Collins English Dictionary, n.d.). Since the late 1990’s, zoos and aquariums around the world have moved away from being places simply for entertainment (Fraser & Wharton, 2007). There has been a strong shift towards in-situ and ex-situ conservation work, with a deliberate effort to educate and inspire visitors to engage in pro-environmental behaviours (Ogden & Heimlich, 2009; Patrick et al., 2007; Rabb, 2004; Routman et al., 2022; Visscher et al., 2009).

A study in 2007 of 136 zoos accredited by the Association of Zoos and Aquariums America (AZA) found that ‘conservation’ and ‘education’ were the two most prominent themes in the zoos’ mission statements (Patrick et al., 2007). Zoos recognise that in order to accomplish the best conservation

outcomes, they need to be inspiring visitors to engage in pro-environmental behaviours beyond the zoo gates. The zoo accrediting body, the World Association of Zoos and Aquariums (WAZA) states;

*“Instilling in all visitors a strong sense of excitement about and a desire to care for life on earth will create a solid platform for fulfilling the promise to care for and conserve wildlife. Zoological facilities are uniquely positioned to use a social-science, evidence-based approach to influence pro-environmental behaviour”*

(World Association of Zoos and Aquariums, 2015, pg 17).

This review focuses on modern, accredited zoos and aquariums (henceforth referred to as ‘zoos’) in order to exclude non-accredited facilities whose individual purposes may differ from one of inspiration, education and conservation.

### 1.1.2 Purpose of Education in Zoos

The WAZA conservation strategy emphasises that education, both formal and informal (planned or impromptu education efforts aimed at public visitors, including behind-the-scenes experiences, keeper talks, public animal feedings, etc) is essential to achieving zoo conservation outcomes, and should be a central part of their organisational strategy (World Association of Zoos and Aquariums, 2005). According to WAZA the role of education is to “interpret living collections to attract, inspire and enable people from all walks of life to act positively for conservation” (World Association of Zoos and Aquariums, 2005, pg 35).

Many studies have shown that formal educational presentations incorporated into zoo visits result in a marked increase in learning and conservation attitudes (C. Collins et al., 2020). This is attributed to zoos’ unique position – having both human expertise and live animals – as ideal environments for creating meaningful connections between human participants and wildlife, and to foster a love for nature (Ogle, 2016; Povey & Rios, 2002).

As with science communication as a whole, the purpose of education in zoos has undergone a vast shift since the early 2000’s (Routman et al., 2022). Historically, most education programs were focused on simple dissemination of knowledge, under the premise that understanding animals and the environment better will intrinsically lead participants to care more and undertake more pro-environmental behaviours in their lives (Hungerford & Volk, 1990). However, recent research shows us that knowledge and behaviour are not inherently linked in such a linear way, and that an emotional connection to the subject is required for the kind of attitude change required to increase uptake in pro-environmental behaviours (Hungerford & Volk, 1990; Povey & Rios, 2002).

For the purpose of this review the terminology of ‘pro-environmental behaviours’ defined as ‘any action that benefits or is intended to benefit wildlife and/or the environment, and/or reduce anthropogenic environmental impacts’ is used in line with WAZA policies (Clifford-Clarke et al., 2021; Routman et al., 2022). The type of pro-environmental behaviours emphasised by zoo education programs will vary depending on geographic location, lesson topic (whether native or exotic animals are involved in the program), and the focus of the zoo or school.

### 1.1.3 Using Animals in Zoo Education Programs

Animals are often used in school classrooms in an effort to teach responsibility, encourage participation and learning, and create a more inviting learning environment (Gee et al., 2017). While research conducted into the effect of animals in school classrooms finds that they do result in a measurable increase in student learning, the reason for the effect is not yet fully understood (Gee et al., 2017; Wohlfarth et al., 2013).

Many zoos and zoo educators claim that using AVIs helps to make education programs more appealing and effective, and increases participants attention, information retention, and connectedness with nature (5). WAZA supports the use of AVIs in zoo education programs under the claim that there is evidence to show they increase uptake in pro-environmental behaviours and assist in learning (Association of Zoos and Aquariums, 2018; World Association of Zoos and Aquariums, 2020).

AZA defines AVIs as “Any encounter where an animal and visitor are brought together for physical/near physical interaction” (Association of Zoos and Aquariums, 2018). One study found that some form of AVI (involving direct contact such as stroking) occurs in nearly half of the zoos they surveyed, and the use of AVIs in education programs is increasing (D’Cruze et al., 2019; Spooner et al., 2021; World Association of Zoos and Aquariums, 2020).

## 1.2 Justification of Research

Due to a lack of research into formal education programs, many zoos unwittingly use extrapolated information from research into informal education, to support the claim that using AVIs within formal education programs improves uptake in pro-environmental behaviours (Spooner et al., 2021). Despite the popularity of AVIs within zoo education, research and evaluation of the practice is noted to be severely limited (Davies et al., 2021; Learmonth et al., 2021; Spooner et al., 2021).

Accredited zoos are highlighted as conservation institutions, designed to make significant contributions to conservation through in-situ, ex-situ, and educational programs (World Association of Zoos and Aquariums, 2005). They are placed as leaders in environmental and conservation understanding, and disseminating that information to influence attitudes and behaviour towards wildlife and the environment on a local and global scale (World Association of Zoos and Aquariums, 2005). If they are to both deserve and uphold these claims, zoos should be responsible for ensuring their practices are both effective and scientifically sound (Routman et al., 2022).

Added to this responsibility, zoos have an obligation to provide – and prove that they are providing – the very best care for their animals. With many critics claiming that zoos have a negative effect on their animals, and do not meet the conservation contribution they claim, it is important that they have the scientific evidence to support their claims of best practice in animal care, conservation contribution, and promoting pro-environmental behaviours (Godinez & Fernandez, 2019).

## 1.3 Aims and Research Question

This review aims to establish whether using AVIs in formal zoo education programs does increase uptake in pro-environmental behaviours, and what evidence there is to support this claim.

This is done by establishing what evidence there is to support the current educational practices used by many zoos, whether these can truly be considered best practice, and what areas there are for improvement.

## 2 Methods

A Boolean search for literature was initially conducted using the University of Western Australia’s One Search and Google Scholar to obtain a broad range of papers. Due to the specificity of the topic, research referenced by relevant papers were also analysed for further literature. The following journals were identified as containing much of the relevant literature and were searched more thoroughly for further information;

- Journal of Zoo and Aquarium Research
- Journal of Zoo Biology
- Journal of Zoological and Botanical Gardens

Due to the lack of research into the field, there is little standardisation of terminology. Therefore, many different search terms were used in order to obtain as much of the relevant literature as possible. With new terminology added as it was found in relevant literature. This included;

Table 1. Terminology used in Boolean search for literature

Search	AVI focus	Education focus	Outcome
1	Animal-Visitor interact*	Zoo education	Conservation behaviour*
2	Human-animal interact*	Conservation education	
3	Animal contact	Environmental education	Pro-environmental behaviour*

### 2.1 Narrowing of Results

In order to be included studies had to be peer reviewed, and written in English. But could be based anywhere in the world. To better assess suitability of the studies, and analyse where the current research stands, a coding system (figure 1) was developed to categorise studies based on their focus.

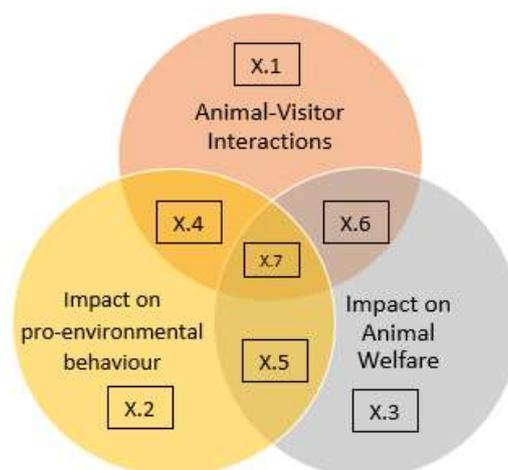


Figure 1: References were coded with X.Y depending on topic. Where X = (1) formal, or (2) informal/public. Y = type of impact studied as shown in the diagram.

Only studies which directly addressed zoo education efforts – either formal or informal – in accredited zoos or aquariums were evaluated. In addition, these studies also had to address at least one of the following criteria to be considered for further review;

- Impact on pro-environmental behaviours
- Animal-Visitor interactions impact on pro-environmental behaviours

Therefore, only on papers coded with X.2, X.4, X.5, or X.7 were fully analysed for the review

## 2.2 Timeframe

The early 2000’s saw the height of a shift in focus of zoo education from a knowledge based deficit model, to focusing on inspiring behavioural change towards an increase in pro-environmental behaviours (Ogden & Heimlich, 2009; Patrick et al., 2007; Tribe & Booth, 2003; Visscher et al., 2009). As such, studies were only included for review if less than 10 years old. Some older papers from the early 2000’s were also included as they were found to be highly relevant and cited extensively in relevant literature.

## 2.3 Limitations of Scope of the Review

The initial intention of this review was to examine the difference in efficacy of contact versus non-contact AVIs within formal zoo education programs. However, it was found that there is a severe lack of research on the use of animals in formal zoo education programs, and none that distinguished between contact and non-contact interactions. As such, it was decided to loosen the specificity of the review to the efficacy of any AVI in formal zoo education programs. Due to a further lack of research into this loosened topic, research into AVIs within the whole zoo context was analysed in order to extrapolate findings into the formal zoo education field.

## 3 Results

Of the studies found, 20 were found to be relevant and fully analysed. Of these 10 were focused on the impact of zoo education programs alone on the uptake of pro-environmental behaviours (X.2, X.5), and 10 looked at the impact of AVI’s within zoo education programs on the uptake of pro-environmental behaviours (X.4, X.7) (Table 2). Also of note, 15 of the 20 studies focused on informal education (2.Y), while 5 focused on formal education programs (1.Y), showing a severe lack of research into formal education programs as a whole. But an even greater lack of research was found into the use of AVIs in formal education programs, with only 3 studies having this focus (1.4) (Table 2). It is also interesting to note that all three of these studies are extremely recent, with one being published in 2022, the others in 2023, showing that this is a topic which has only recently become focus of research.

*Table 2: Number of articles found addressing each research code*

Code	n	1.2	1.4	1.5	1.7	2.2	2.4	2.5	2.7
Number of Articles	20	1	3	1	0	8	5	0	2

Most of these studies were based at single zoos, and with small samples sizes. It was also found that very few contained control groups to establish the difference between the use of AVIs or not in the education programs.

### 3.1 Impact of Zoo Education Programs Without Animal-Visitor Interactions (X.2; X.5)

It is important to note that these studies did not exclude the use of animals entirely in education programming, but there were no direct AVIs. Participants were still able to see animals on exhibit or interacting with their keepers such as in a keeper talk, but animals were always within their regular exhibit.

The results of these studies showed that zoo education programs in general are very effective at increasing the uptake of pro-environmental behaviours without the use of AVIs. The most important aspect in making these education programs effective is that they are interpretive – being delivered by a zoo staff member/volunteer – over relying on static education options like signs, where visitors must be self-motivated to read and learn (Godinez & Fernandez, 2019; Pearson et al., 2014; Visscher et al., 2009).

Pearson et al, (2014) evaluated the ‘Don’t Palm Us Off’ campaign run by Zoos Victoria, finding it to be highly successful at increasing visitors’ knowledge of palm oil and the issues it causes, as well as developing ongoing pro-environmental behaviours in visitors. This public campaign did not utilise AVIs in any aspect of the education efforts.

Collins et al, (2019) undertook a control experiment to establish whether participating in a formal education program or not will impact students’ behaviour towards the animals within the zoo. This study found that participating in the education program showed a significant increase in students’ positive behaviour, as well as significantly reduced negative behaviours in comparison to students that did not participate in the education program (C. Collins et al., 2019)

Swanagan (2000) attempted to establish whether watching an elephant demonstration would result in high pro-environmental behaviours, as compared to not watching a demonstration. While they did find modest support to the hypothesis that watching the demonstration would result in a greater uptake in pro-environmental behaviours, they did note the difficulty in establishing long term behaviour change, due to a very low return of solicitation following the participants visit (Swanagan, 2000). This lack of follow up from study participants was found to be a difficulty for of the studies in attempting to establish long term behaviour change.

Godinez & Fernandez (2019) found that when visiting zoos, visitors are more likely to spend a higher amount of time interacting with an exhibit (reading signs, asking questions of staff or other visitors present, etc) when the animals are active. This higher interest in the animal and their exhibit was also claimed to result in increased knowledge of the animal and potential pro-environmental behaviours (Godinez & Fernandez, 2019). In this way, it was found that keeper talks and demonstrations (where animals are still within their own exhibit and free to participate or not) are more successful at increasing knowledge and pro-environmental behaviours than viewing exhibits alone, as the animals are generally more active, interacting with their keepers, or being fed during these demonstrations (Godinez & Fernandez, 2019; Luebke, 2018; Miller et al., 2013; Swanagan, 2000; Visscher et al., 2009).

### 3.2 Impact of Animal-Visitor Interactions Within Public Zoo Education Programs (2.4; 2.7; 3.4; 3.7)

The majority of these articles claimed to provide evidence to support the belief of increased uptake in pro-environmental behaviours as a result of using AVIs (Clifford-Clarke et al., 2021; C. K. Collins et al., 2021; Mori et al., 2019; Povey & Rios, 2002; Rank et al., 2021).

Povey & Rios (2002), claimed that using AVIs in clouded leopard demonstrations increased visitor learning and uptake of pro-environmental behaviours. However, this was based on the observed longer viewing times of the exhibit and animals, with no direct testing of visitors to establish learning.

Another study undertook pre- and post- testing of visitors interacting with an aquarium's touch pool, to establish knowledge gain and behavioural change, finding an increase in both knowledge and likelihood to undertake pro-environmental behaviours (Ogle, 2016). However, as with most other similar studies, this study did not include a control where participants did not engage with an AVI, to establish whether it was the AVI which caused the change in behaviour and knowledge.

Whitehouse-Tedd et al, (2022) compared the change in visitor knowledge and pro-environmental attitudes following an AVI (touching a cheetah), a guided tour of the animal facility, or a guided tour followed by an AVI. This study found a significant increase in knowledge in both groups which participated in a tour, in comparison to the AVI only group. But no significant difference in knowledge was found between the tour only group and the combined group (Whitehouse-Tedd et al., 2022). This suggests that the tour was the contributing factor in increasing knowledge among participants, not the AVI. The authors also noted that 27% of participants exhibited a knowledge decrease, most prominently in the AVI only group (Whitehouse-Tedd et al., 2022).

### 3.3 Impact of Animal-Visitor Interactions Within Formal Zoo Education Programs (1.4; 1.7; 3.4)

One US study addressing the effect of AVIs in formal zoo education programs on uptake of pro-environmental behaviours found that the education programs did have a positive effect on students attitudes towards local wildlife and their willingness to participate in pro-environmental behaviours (Jerger et al., 2022). These programs consisted of an 'animal expert' teaching students about local wildlife with an animal ambassador present for each program. It should be noted that there was no control groups in this research where students participated in an education program with no AVI, or participated in an AVI with no education program. Therefore, the precise cause of the increase in pro-environmental behaviours is impossible to determine.

Similarly, Farmerie et al. (2023) also showed a positive change in attitudes from students following education programs consisting of students caring for and working with Koi fish. These programs involved long-term, high-level interactions between the students and the animals, as opposed to a short, keeper led 'meet and greet' that would often be involved in an AVI. It should also be noted that there were also no control groups in this study, with student experiencing the same teachings, but without the AVI. Making the impact of the AVI itself difficult to determine above the impact of the teaching program.

Priestly et al. (2023), out of Melbourne Zoo, studied the effectiveness of 'welfare based AVIs'. These are no contact and occur in the animals normal habitat, and keepers will offer enrichment or food as

an incentive to participate, but participation is entirely free-choice for the animal (Priestley et al., 2023). Therefore, these AVIs are not entirely beyond what could be expected by the general public, and therefore perhaps could not be considered as a true AVI. However, this study could be used as a control study for other studies, as the students involved did experience an educational program, but without an AVI, giving a basis of comparison.

The results of the study did report “positive emotional responses, an increase in animal knowledge, and an understanding of the importance of providing animals with choice and control over their interactions with people” (Priestley et al., 2023, pg75). However, it should be noted that the study relied on students self-reporting on their own knowledge and behaviour change, and only post-testing was conducted, so there is no quantifiable evidence of increase.

## 4 Discussion

### 4.1 Identification of Gaps in the Literature

The overwhelming majority (83%) of research into the effectiveness of zoo education focuses on the informal aspect of education (keeper talks, signage, behind the scenes experiences, etc), with many research papers on ‘zoo education’ explicitly stating that they *excluded* ‘formal’ zoo education programs. Of the 18 papers analysed, only 3 addressed a formal education program.

The lack of research on the topic was directly addressed by the majority of authors, stating that more research needs to be done if we are to ensure best practice within the field (Moss & Esson, 2013; Ogden & Heimlich, 2009; Rank et al., 2021; Spooner et al., 2021; Swanagan, 2000).

Due to this lack of research into formal education programs, this review has been forced to focus on research around public education programs in order to extrapolate evidence to answer the initial research question.

### 4.2 Findings from the Literature

Povey & Rios (2002) explain that many zoo educators find that using animals in presentations more effectively engages the audience, leading to meaningful connections between participants and the animals. “People are drawn to animals, and are drawn even more when they have an opportunity for making a closer connection” (Povey & Rios, 2002, pg 21). However, this evidence appears to be purely anecdotal from zoo educators, as the authors provide no evidence of how these claims were established.

### 4.3 Interesting Animals Equal Interested People

Godinez & Fernandez (2019) found that when animals are visible and/or active, zoo visitors are more likely to spend more time at the exhibit, which *may* then result in more learning and connection to the animal. This finding is perhaps one of the founding points to the claim that using AVIs improves uptake in pro-environmental behaviours. The animals are generally more active when being used in AVIs, which would result in more interested visitors. These findings are backed up by Rank et al (2021) in which zoo visitors self-identified as feeling more connected to animals the closer they felt to them while observing the animals in their exhibit. Based on this information one could claim a logical

extrapolation that the closer one can get to an active animal the more interested one will be in learning about that animal, and the more likely they would be to establish a connection and participate in pro-environmental behaviours. However, this extrapolation does not appear to be backed up by research.

The literature overwhelmingly supports the claim that visitors will spend more time watching and actively learning about an animal when that animal is active and ‘interesting’ (Godinez & Fernandez, 2019; Learmonth et al., 2021; Povey & Rios, 2002; Rank et al., 2021), and zoos can use this information to tailor education experiences to include animals in ways that research shows improves uptake of pro-environmental behaviours (Povey & Rios, 2002; Rank et al., 2021). However, while animals are generally more active during AVIs, and visitors are likely to be engaged by the novelty of seeing an animal interacting with staff, research should be undertaken to establish if the same level of engagement and connection could be achieved through training or feeding the animal, rather than close contact or bringing the animal out of its natural exhibit, which has the potential to cause undue stress to the animal.

Jerger et al (2022), evaluated the effectiveness of education programs utilising animals in influencing students’ attitudes towards local wildlife. This study found that the education programs were highly effective in improving attitudes towards wildlife, and likelihood in participating in pro-environmental behaviours (Jerger et al., 2022). This study strongly supports the claim for using AVIs in formal education programs to increase uptake in pro-environmental behaviours, but like many other studies, did not include control groups to establish the true cause of the change. When engaging in an education program, there must be a human expert present to teach participants about the animals and conservation, so it can be difficult to determine whether the program itself, or the AVI is the cause of the change.

The inclusion of Priestly et al, (2023), shows that an increase in uptake of pro-environmental behaviours may be possible without the use of contact AVIs. By having a human expert present to teach *and* facilitate a non-contact ‘welfare based’ interaction, whereby the animal is not interfered with in anyway, we may still see similar increases in attitudes and uptake in pro-environmental behaviours (Priestley et al., 2023). However, as this is the only study existing as a control – and which itself still doesn’t have both control and experimental groups – further study is still needed to establish the full impact of including AVI’s in education programs.

#### 4.4 Interpretive Education is More Effective Than Static Education

Evidence from many different educational arenas shows that interpretive education programs are much more effective at increasing pro-environmental behaviours, when compared to static education efforts such as signage (Rank et al., 2021; Visscher et al., 2009; Whitehouse-Tedd et al., 2022). When AVIs are utilised in education programs, there must be a professional present to run the interaction and monitor the animals’ well-being. These professionals are also there to share information and answer questions, so it can be extremely difficult to separate the effect of the interpretive education provided, and the effect of the AVI in impacting participants’ attitudes.

The ‘Don’t Palm Us Off’ campaign run at Zoos Victoria was a public campaign to educate visitors about the issues with palm oil, and encourage people to engage in pro-environmental behaviours – specifically engaging with government to change labelling laws (Pearson et al., 2014). This campaign

did not incorporate any AVIs as part of the education programs. Despite the lack of AVIs, this program was found to be extremely effective in developing ongoing pro-environmental behaviours in visitors surveyed (Pearson et al., 2014). Seeing the effectiveness of a program without the use of any AVIs calls into question their necessity.

Very few studies into the effectiveness of AVIs in education programs included control groups that involved an education program but with no AVI. This makes it very difficult to fully establish the cause of any increase in pro-environmental behaviours that the study may find.

#### 4.5 Animal-Visitor Interactions Make Little Difference

Whitehouse-Tedd et al (2022) was able to compare different interpretation methods in an attempt to distinguish what results in the greatest increase in visitor's pro-environmental behaviours. The study compared the attitudes of three groups involved in education on cheetahs. The first group was involved in a direct AVI – petting a conditioned cheetah – with minimal education from staff. The second group participated in a guided tour of the facility with a staff member sharing information and answering questions, but with no AVI. While the third group participated in both the guided tour and the AVI. Participants in the AVI alone showed minimal increase in knowledge (with some participants showing a decrease in knowledge), and very low increase in willingness to engage in pro-environmental behaviours. All participants in the guided tour showed a marked increase in both knowledge and willingness to participate in pro-environmental behaviours, but there was no statistically significant difference between the tour only and tour/AVI groups. These findings show very well that it would appear to be the presence of a professional talking with participants which has the greatest effect, and that AVIs alone are unlikely to improve uptake in pro-environmental behaviours.

Similarly, Clifford-Clarke et al, (2021) conducted control research of zoo visitors interactive with a penguin exhibit, to establish what level of AVI is most effective in causing attitude and behavioural change. This study involved three groups of visitors, one group participating in exhibit viewing only, one group viewing a penguin keeper talk, and one group engaging in a behind-the-scenes experience, hand feeding penguins with the guidance of a penguin keeper, who also shared information about penguins (Clifford-Clarke et al., 2021). As with Whitehouse-Tedd et al (2022), this study found that participating in an education program – keeper talk or behind-the-scenes with a keeper – was extremely effective in increasing participant knowledge and uptake in pro-environmental behaviours (Clifford-Clarke et al., 2021). But the addition of an AVI (feeding the penguins) showed no significant increase in knowledge or uptake in pro-environmental behaviours as compared to education only (Clifford-Clarke et al., 2021). The authors came to the conclusion that;

“This study found no evidence to support previous claims that close contact interactions between visitors and animals improved conservation education outcomes (as measured by pro-environmental behaviour intention) beyond that achieved by other zoo experiences”

(Clifford-Clarke et al, 2021, pg 15).

All studies using a control group found that participating in an education program with a professional made a strong positive impact on visitors, but the addition of an AVI to that education program

showed no statistically significant increase on the program alone. In fact, Whitehouse-Tedd et al (2022) found a decrease in knowledge in some participants, which was particularly prominent in those who undertook the AVI alone. When combining this with other studies finding that education programs with AVIs are effective at increasing pro-environmental behaviours, but which don't include control groups with the AVI, it does call into question the effectiveness and necessity of AVIs in formal education programs.

## 5 Conclusion

As zoos are shifting to a model of conservation and education, the use of AVIs in zoo education programs is increasing in an attempt to improve conservation outcomes and reach. As such, it is important to have evidence to show that this practice is effective for increasing uptake in pro-environmental behaviours in participants. This review examined relevant literature to establish what evidence there is to support the claim that using AVIs in formal zoo education programs increases uptake in pro-environmental behaviours.

The main finding of this review was a serious lack of research into formal zoo education as a whole, and even less into the use of AVIs in these programs. Therefore, any previous claims have been, and now must be made from results extrapolated from informal zoo education research.

It is well supported that visitors are more likely to be engaged with an exhibit – including reading information material – when animals are active or 'more interesting' which many will extrapolate to mean that the more interesting the animal (ie, being able to touch or feed the animal), the more engaged and connected the human will feel. Therefore, they will be more likely take up pro-environmental behaviours. However, this appears to be purely an extrapolation of information, as there is little research that tests this hypothesis.

A large amount of evidence from schools, zoos, museums, and other informal learning venues shows us that interpretive education is far more effective at achieving outcomes than relying exclusively on static education such as signage (Clifford-Clarke et al., 2021; Pearson et al., 2014; Visscher et al., 2009; Whitehouse-Tedd et al., 2022). These studies show that interpretive education programs can be extremely effective even without the use of AVIs.

Where AVIs were included in the research, the programs were found to be effective, but rarely included a control group which had the interpretive education but no AVI, or engaged with an AVI with no interpretive education. This makes it extremely difficult to establish the true cause of the improvement. The two studies that did include control groups both found that the addition of an AVI to the education program had minimal or no benefit to uptake in pro-environmental behaviours on top of the education program itself (Clifford-Clarke et al., 2021; Whitehouse-Tedd et al., 2022).

While there is no literature that finds AVIs have a negative effect on human participants, and we can extrapolate information to claim that they will help gain and hold participant engagement, evidence to support the claim that AVIs improve uptake in pro-environmental behaviours is ambiguous at best.

AVIs are undoubtedly not detrimental to education programs. But they may not necessarily be essential to increase uptake in pro-environmental behaviours. In which case, more research is needed

to categorically establish the effect on the animals involved. If the effect on animals is negligible or positive, then there is no need to remove the practice. But if the effect on the animals is negative, then we need to seriously re-evaluate whether the minimal benefit to humans is worth the negative impact on animals.

## 6 Future Research

As part of accreditation zoos should always be striving for best practice based on evidence. If the research is not being done, then we cannot guarantee best practice, or know where and how we can improve regarding successful promoting of pro-environmental behaviour (Routman et al., 2022).

More research is needed on formal education programs specifically, with or without AVIs. While we can extrapolate classroom pedagogical research, zoos offer a vastly different learning scenario which should be embraced and utilised to its fullest extent. This can only be done with relevant directed research.

AVIs will also have an impact on animal welfare (Baird et al., 2016; C. Collins et al., 2019; Mori et al., 2019; Priestley et al., 2023; Whitehouse-Tedd et al., 2022). While these are accounted for and mitigated as much as possible, and results are varied as to whether these impacts are positive or negative, if AVIs do not have the impact claimed, then we are perhaps causing unnecessary stress to the animals involved for no benefit (Clifford-Clarke et al., 2021).

Most importantly, control experiments are needed to establish whether the use of AVIs or the interaction with a human expert is the cause of increase in uptake of pro-environmental behaviours. Once we have those results, we can further research and establish the level of AVI required to get the best participant outcome with the least impact on the animals involved.

## References

- Association of Zoos and Aquariums. (2018). *Ambassador Animal Policy*.  
[https://assets.speakcdn.com/assets/2332/ambassador\\_animal\\_policy\\_2015.pdf](https://assets.speakcdn.com/assets/2332/ambassador_animal_policy_2015.pdf)
- Baird, B. A. (2018). *Ambassador Animal Welfare: Using Behavioral and Physiological Indicators to Assess the Well-Being of Animals Used for Education Programs in Zoos* [Ph.D., Case Western Reserve University].  
<https://www.proquest.com/docview/2427501023/abstract/2D47E9A606474E9APQ/1>
- Baird, B. A., Kuhar, C. W., Lukas, K. E., Amendolagine, L. A., Fuller, G. A., Nemet, J., Willis, M. A., & Schook, M. W. (2016). Program animal welfare: Using behavioral and physiological measures to assess the well-being of animals used for education programs in zoos. *Applied Animal Behaviour Science*, 176, 150–162. <https://doi.org/10.1016/j.applanim.2015.12.004>
- Clifford-Clarke, M. M., Whitehouse-Tedd, K., & Ellis, C. F. (2021). Conservation Education Impacts of Animal Ambassadors in Zoos. *Journal of Zoological and Botanical Gardens*, 3(1), 1–18.  
<https://doi.org/10.3390/jzbg3010001>
- Collins, C., Corkery, I., McKeown, S., McSweeney, L., Flannery, K., Kennedy, D., & O’Riordan, R. (2020). An educational intervention maximizes children’s learning during a zoo or aquarium visit. *The Journal of Environmental Education*, 51(5), 361–380.  
<https://doi.org/10.1080/00958964.2020.1719022>
- Collins, C. K., McKeown, S., & O’Riordan, R. (2021). Does an Animal–Visitor Interactive Experience Drive Conservation Action? *Journal of Zoological and Botanical Gardens*, 2(3), 473–486.  
<https://doi.org/10.3390/jzbg2030034>
- Collins, C., Quirke, T., McKeown, S., Flannery, K., Kennedy, D., & O’Riordan, R. (2019). Zoological education: Can it change behaviour? *Applied Animal Behaviour Science*, 220, 104857.  
<https://doi.org/10.1016/j.applanim.2019.104857>
- Collins English Dictionary. (n.d.). *Zoo definition and meaning*. Retrieved 24 August 2022, from <https://www.collinsdictionary.com/dictionary/english/zoo>
- Davies, N., Sowerby, E., & Johnson, B. (2021). Assessing the Impacts of Engaging with a Touch Table on Safari Park Visitors. *Journal of Zoological and Botanical Gardens*, 2(3), 370–381.  
<https://doi.org/10.3390/jzbg2030026>
- D’Cruze, N., Khan, S., Carder, G., Megson, D., Coulthard, E., Norrey, J., & Groves, G. (2019). A Global Review of Animal–Visitor Interactions in Modern Zoos and Aquariums and Their Implications for Wild Animal Welfare. *Animals* (2076-2615), 9(6), 332–332.  
<https://doi.org/10.3390/ani9060332>
- Farmerie, M., Zyhier, S., Moore, D., Mehall, S., Duffy-Zimmer, S., Locke, J., McNamara, J., Kodama, T., & Hopkins, M. (2023). Making waves and changing youth perceptions about fish through an

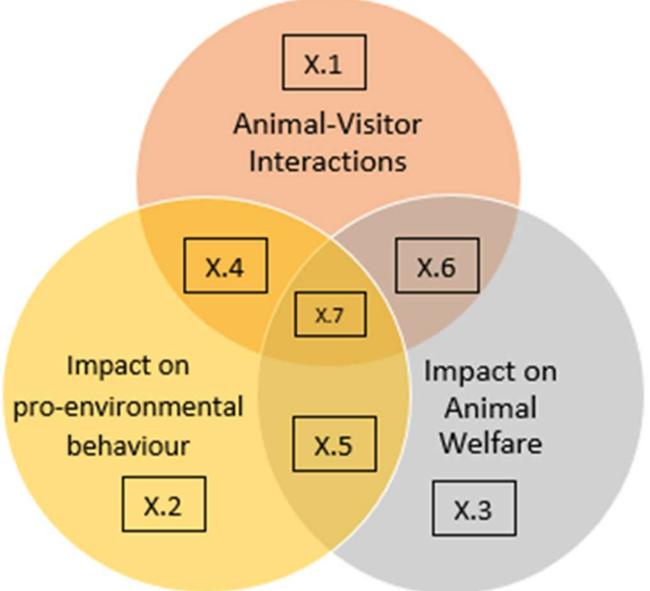
- educational human-animal interaction (HAI) program with koi: The HAI-CEWHALL Program. *International Zoo Educators Association Journal*, 59, 61–68.
- Fraser, J., & Wharton, D. (2007). The Future of Zoos: A New Model for Cultural Institutions. *Curator: The Museum Journal*, 50(1), 41–54. <https://doi.org/10.1111/j.2151-6952.2007.tb00248.x>
- Gee, N. R., Griffin, J. A., & McCardle, P. (2017). Human–Animal Interaction Research in School Settings: Current Knowledge and Future Directions. *AERA Open*, 3(3), 2332858417724346. <https://doi.org/10.1177/2332858417724346>
- Godinez, A. M., & Fernandez, E. J. (2019). What Is the Zoo Experience? How Zoos Impact a Visitor’s Behaviors, Perceptions, and Conservation Efforts. *Frontiers in Psychology*, 10, 1746. <https://doi.org/10.3389/fpsyg.2019.01746>
- Hungerford, H. R., & Volk, T. L. (1990). Changing Learner Behavior Through Environmental Education. *The Journal of Environmental Education*, 21(3), 8–21. <https://doi.org/10.1080/00958964.1990.10753743>
- Jerger, A. D., Acker, M., Gibson, S., & Young, A. M. (2022). Impact of animal programming on children’s attitudes toward local wildlife. *Zoo Biology*, 40, 1–10. <https://doi.org/10.1002/zoo.21702>
- Learmonth, M. J., Chiew, S. J., Godinez, A., & Fernandez, E. J. (2021). Animal-Visitor Interactions and the Visitor Experience: Visitor Behaviors, Attitudes, Perceptions, and Learning in the Modern Zoo. *Animal Behavior and Cognition*, 8(4), 632–649. <https://doi.org/10.26451/abc.08.04.13.2021>
- Luebke, J. F. (2018). Zoo Exhibit Experiences and Visitors’ Affective Reactions: A Preliminary Study. *Curator: The Museum Journal*, 61(2), 345–352. <https://doi.org/10.1111/cura.12253>
- Miller, L. j., Zeigler-Hill, V., Mellen, J., Koepfel, J., Greer, T., & Kuczaj, S. (2013). Dolphin Shows and Interaction Programs: Benefits for Conservation Education? *Zoo Biology*, 32(1), 45–53. <https://doi.org/10.1002/zoo.21016>
- Mori, B. de, Ferrante, L., Florio, D., Macchi, E., Pollastri, I., & Normando, S. (2019). A Protocol for the Ethical Assessment of Wild Animal-Visitor Interactions (AVIP) Evaluating Animal Welfare, Education, and Conservation Outcomes. *Animals: An Open Access Journal from MDPI*, 9(8), E487. <https://doi.org/10.3390/ani9080487>
- Moss, A., & Esson, M. (2013). The Educational Claims of Zoos: Where Do We Go from Here? *Zoo Biology*, 32(1), 13–18. <https://doi.org/10.1002/zoo.21025>
- Ogden, J., & Heimlich, J. E. (2009). Why focus on zoo and aquarium education? *Zoo Biology*, 28(5), 357–360. <https://doi.org/10.1002/zoo.20271>
- Ogle, B. (2016). Value of Guest Interaction in Touch Pools at Public Aquariums. *Universal Journal of Management*, 4, 59–63. <https://doi.org/10.13189/ujm.2016.040202>

- Patrick, P. G., Matthews, C. E., Ayers, D. F., & Tunnicliffe, S. D. (2007). Conservation and Education: Prominent Themes in Zoo Mission Statements. *Journal of Environmental Education, 38*(3), 53–60. <https://doi.org/10.3200/JOEE.38.3.53-60>
- Pearson, E., Lowry, R., Dorrian, J., & Litchfield, C. (2014). Evaluating the conservation impact of an innovative zoo-based educational campaign: ‘Don’t Palm Us Off’ for orang-utan conservation: ‘Don’t Palm Us Off’ Evaluation. *Zoo Biology, 33*. <https://doi.org/10.1002/zoo.21120>
- Povey, K. D., & Rios, J. (2002). Using Interpretive Animals to Deliver Affective Messages in Zoos. *Journal of Interpretation Research, 7*(2), 19–28. <https://doi.org/10.1177/109258720200700203>
- Priestley, C., Jaensch, S., & McLeod, E. M. (2023). Evaluating the effectiveness of welfare-focused animal encounters to deliver education programs. *International Zoo Educators Association Journal, 59*, 69–76.
- Rabb, G. B. (2004). The Evolution of Zoos from Menageries to Centers of Conservation and Caring. *Curator: The Museum Journal, 47*(3), 237–246. <https://doi.org/10.1111/j.2151-6952.2004.tb00121.x>
- Rank, S. J., Roberts, S.-J., & Manion, K. (2021). The Impact of Ambassador Animal Facilitated Programs on Visitor Curiosity and Connections: A Mixed-Methods Study. *Animal Behaviour and Cognition, 8*(4), 18. <https://doi.org/10.26451/abc.08.04.08.2021>
- Routman, E. O., Khalil, K., Wesley Schultz, P., & Keith, R. M. (2022). Beyond inspiration: Translating zoo and aquarium experiences into conservation behavior. *Zoo Biology, 40*. <https://doi.org/10.1002/zoo.21716>
- Spooner, S. L., Farnworth, M. J., Ward, S. J., & Whitehouse-Tedd, K. M. (2021). Conservation Education: Are Zoo Animals Effective Ambassadors and Is There Any Cost to Their Welfare? *Journal of Zoological and Botanical Gardens, 2*(1), 41. <https://doi.org/10.3390/jzbg2010004>
- Swanagan, J. S. (2000). Factors Influencing Zoo Visitors’ Conservation Attitudes and Behavior. *Journal of Environmental Education, 31*(4), 26. <https://doi.org/10.1080/00958960009598648>
- Tribe, A., & Booth, R. (2003). Assessing the Role of Zoos in Wildlife Conservation. *Human Dimensions of Wildlife, 8*(1), 65–74. <https://doi.org/10.1080/10871200390180163>
- Visscher, N. C., Snider, R., & Vander Stoep, G. (2009). Comparative analysis of knowledge gain between interpretive and fact-only presentations at an animal training session: An exploratory study. *Zoo Biology, 28*(5), 488–495. <https://doi.org/10.1002/zoo.20174>
- Whitehouse-Tedd, K. M., Lozano-Martinez, J., Reeves, J., Page, M., Martin, J. H., & Prozesky, H. (2022). Assessing the Visitor and Animal Outcomes of a Zoo Encounter and Guided Tour Program with Ambassador Cheetahs. *Anthrozoös, 35*(2), 307–322. <https://doi.org/10.1080/08927936.2021.1986263>

- Wohlfarth, R., Mutschler, B., Beetz, A., Kreuser, F., & Korsten-Reck, U. (2013). Dogs motivate obese children for physical activity: Key elements of a motivational theory of animal-assisted interventions. *Frontiers in Psychology, 4*, 796. <https://doi.org/10.3389/fpsyg.2013.00796>
- World Association of Zoos and Aquariums. (2005). *Building a Future for Wildlife: The World Zoo and Aquarium Conservation Strategy*. s.n. <https://www.waza.org/wp-content/uploads/2019/03/wzacs-en.pdf>
- World Association of Zoos and Aquariums. (2015). *Committing to Conservation: The World Zoo and Aquarium Conservation Strategy*. <https://www.waza.org/>.  
<https://www.waza.org/priorities/conservation/conservation-strategies/>
- World Association of Zoos and Aquariums. (2020). *WAZA Animal-Visitor Interaction Guidelines—WAZA*. <https://www.waza.org/>. <https://www.waza.org/priorities/animal-welfare/waza-animal-visitor-interaction-guidelines/>

## 7 Appendix A: Coded References

<b>1.2</b>	<b>1.4</b>	<b>1.5</b>	<b>1.7</b>
Visscher, N. C., Snider, R., & Vander Stoep, G. (2009). Comparative analysis of knowledge gain between interpretive and fact-only presentations at an animal training session: An exploratory study.	Jerger, A. D., Acker, M., Gibson, S., & Young, A. M. (2022). Impact of animal programming on children’s attitudes toward local wildlife.	Collins, C., Quirke, T., McKeown, S., Flannery, K., Kennedy, D., & O’Riordan, R. (2019). Zoological education: Can it change behaviour?	
	Farmerie M, Zyhier S, Moore D, Mehall S, Duffy-Zimmer S, Locke J, et al. (2023) Making waves and changing youth perceptions about fish through an educational human-animal interaction (HAI) program with koi: The HAI-CEWHALL Program.		
	Priestley C, Jaensch S, McLeod EM. (2023) Evaluating the effectiveness of welfare-focused animal encounters to deliver education programs.		
<b>2.2</b>	<b>2.4</b>	<b>2.5</b>	<b>2.7</b>
Godinez, A. M., & Fernandez, E. J. (2019). What Is the Zoo Experience?	Ogle, B. (2016). Value of Guest Interaction in Touch Pools at Public Aquariums.		Mori, B. de, Ferrante, L., Florio, D., Macchi, E., Pollastri, I., & Normando, S. (2019). A Protocol for the Ethical Assessment of Wild Animal-Visitor Interactions (AVIP) Evaluating Animal Welfare, Education, and Conservation Outcomes.
Routman, E. O., Khalil, K., Wesley Schultz, P., & Keith, R. M. (2022). Beyond inspiration: Translating zoo and aquarium experiences into conservation behavior.	Clifford-Clarke, M. M., Whitehouse-Tedd, K., & Ellis, C. F. (2021). Conservation Education Impacts of Animal Ambassadors in Zoos.		Whitehouse-Tedd, K. M., Lozano-Martinez, J., Reeves, J., Page, M., Martin, J. H., & Prozesky, H. (2022). Assessing the Visitor and Animal Outcomes of a Zoo Encounter and Guided Tour Program with Ambassador Cheetahs.

Moss, A., & Esson, M. (2013). The Educational Claims of Zoos: Where Do We Go from Here?	Collins, C. K., McKeown, S., & O’Riordan, R. (2021). Does an Animal-Visitor Interactive Experience Drive Conservation Action?		
Ogden, J., & Heimlich, J. E. (2009). Why focus on zoo and aquarium education?	Povey, K. D., & Rios, J. (2002). Using Interpretive Animals to Deliver Affective Messages in Zoos.		
Pearson, E., Lowry, R., Dorrian, J., & Litchfield, C. (2014). Evaluating the conservation impact of an innovative zoo-based educational campaign: ‘Don’t Palm Us Off’ for orang-utan conservation: ‘Don’t Palm Us Off’ Evaluation.	Rank, S. J., Roberts, S.-J., & Manion, K. (2021). The Impact of Ambassador Animal Facilitated Programs on Visitor Curiosity and Connections: A Mixed-Methods Study	 <p>X = (1) formal, or (2) informal/public education program. Y = type of impact studied.</p>	
Luebke, J. F. (2018). Zoo Exhibit Experiences and Visitors’ Affective Reactions: A Preliminary Study.			
Swanagan, J. S. (2000). Factors Influencing Zoo Visitors’ Conservation Attitudes and Behavior.			
Miller L j., Zeigler-Hill V, Mellen J, Koeppel J, Greer T, Kuczaj S. Dolphin Shows and Interaction Programs: Benefits for Conservation Education?			