

Assessing the educational value of a zoo placement for veterinary students - a report on student feedback and perceptions

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Abstract

35 Zoological medicine is an expanding field with limited practical training opportunities for veterinary students. Those training programmes that do exist require significant financial and resource investment by both the veterinary schools and zoological organisations involved. This paper summarises the findings of a retrospective survey of student feedback carried out to ascertain the educational value of a compulsory, five-day long zoo clinical placement for final year veterinary students. This work aimed to explore the potential impact of the
40 placement on students' knowledge and attitudes towards zoological medicine, and the role of modern zoos and conservation. Data were collected by means of an end of placement questionnaire (N=200) and statistically analysed for pre- versus post-placement changes and the effect of pre-placement interest and experience on student responses. Despite the short time frame of the placement and lack of opportunity for in depth comprehensive training in
45 zoological medicine, students reported the placement to have a positive educational impact. Over 90% of students stated that their understanding about modern zoos was good or excellent at the end of the placement (compared with 35% prior to the placement) and 43% reported that the placement had a positive impact on their attitudes towards zoos. Students

50 self-reported an increased understanding of the work of zoo clinicians and we recorded a highly significant positive change in the students' reported opinions regarding wildlife conservation in general. Our findings provide preliminary evidence to suggest that even short duration, but immersive zoo based practical training is of positive educational value for veterinary students.

55 Keywords: veterinary education, zoological medicine, experiential learning, immersive training, clinical placement, work integrated learning

Introduction

60 Zoological medicine “integrates veterinary medicine and the principles of ecology and conservation as applied in both natural and artificial environments”¹ and encompasses wildlife, zoo animal and exotic pet medicine. Though it builds on a diverse range of traditional disciplines, its specific integration into the undergraduate veterinary curriculum is a relatively new development. REF To facilitate this process, some universities run exotic companion animal clinics, which provide good opportunities for the students to learn about a well-defined range of species: mostly small mammals, reptiles and birds.^{2,3} Others incorporate wild animals in their clinical teaching, by setting up wildlife clinics, which treat and rehabilitate native wildlife^{4,5} or collaborate with zoological institutions to develop zoo-based clinical training programmes.

70 To improve undergraduate veterinary student understanding of zoological medicine and its application in a zoo setting the University of Nottingham, School of Veterinary Medicine and Science (Nottingham, United Kingdom) formed a partnership with Twycross Zoo, East Midlands Zoological Society (Atherstone, United Kingdom). This partnership ran successfully for 10 years with continuously increasing student numbers up to over 150 per academic year. As part of this co-operation, final (5th) year veterinary students completed a five-day compulsory placement at the zoo. The placement was centred on the provision of experiential learning, being designed to provide practical teaching in a real life, immersive situation. It was hoped that beyond allowing students to develop specific clinical skills, it would demonstrate the value of transferable professional skills and highlight the importance of wildlife conservation and research.

75 The educational impact of this five-day placement was unknown, and to date, no published evidence regarding the educational value of other, similar, immersive experiences is available. Given the significant financial and resource implications of this programme, it was deemed important to carry out ongoing monitoring of the zoo placement. This was conducted using both a formal standardised feedback system through the university and a post-85 placement anonymous survey at the zoo. This paper summarises the main findings from data collected using this post-placement survey.

Methods

Students and the zoo placement

90 Final (5th) year undergraduate veterinary students of the 2016/2017 and 2017/2018 cohorts from the University of Nottingham, School of Veterinary Medicine and Science (Nottingham, United Kingdom) participated in the study (N=227). They completed a five-day compulsory placement, in groups of two or three students at a time. During the placement, they participated in the day-to-day veterinary care of the zoo's animal collection. This included 95 preventative medicine, such as health checks, faecal testing, vaccination, as well as clinical case management, anaesthesia, animal transports and other veterinary duties. Whilst the focus

was on zoo species, the placement aimed to develop students' confidence in the transferability of their existing skills and knowledge to a range of non-traditional species including those commonly kept as pets, such as rabbits, rodents, reptiles and birds.

100 Students received seminar-based teaching sessions on a variety of topics including record keeping, research and conservation activities in zoos, or medicine of specific taxa. A self-directed study component was also incorporated in which the students were required to evaluate a given species, or number of species, kept in the zoo from an animal health, welfare, husbandry, nutrition and management perspective. Student findings were presented
105 to the zoo supervisory team as a written report and a short presentation.

Students were supervised and mentored by the zoo's veterinarians and veterinary nurse, as well as other zoo professionals, including the registrar, research and conservation, animal keeping and curatorial staff.

110 *Data collection and analysis*

Students were asked to complete a self-administered paper-based feedback survey on a voluntary basis at the end of their five-day clinical placement at Twycross Zoo, East Midland Zoological Society. Whilst encouraged to fill out this survey, participation was voluntary and anonymous; no personal information, such as age, gender or nationality, were recorded. No
115 financial or other reward was provided as compensation. The questions included in the survey are presented in Table 1.

Scale ratings represented 1 for worst/most negative to 5 for best/most positive answers.

Free text responses regarding the students' opinions about zoos before (question 3) and after (question 4) the placement were read in full and assessed to identify whether a change
120 between the two was apparent. The perceived change in opinion was converted into a numerical score as follows: -1 for negative change, 0 for no change and 1 for positive change. All scores were assigned by one author (ML) for consistency.

Data for each question were tested for normality using Kolmogorov-Smirnov test. A Chi-square test was used to investigate the relationship between student interest (question 1) and
125 experience (question 2) in zoological medicine, and between each of these two variables and the change in the opinion regarding zoos. Each student's responses were tested separately. A Kruskal-Wallis H test was used to assess the effect of these two variables on the students' responses for questions 5 to 10. The Wilcoxon Signed Rank test was used to compare students' understanding of the work and role of modern zoos (questions 5 vs 6); the work and
130 role of veterinarians within a zoo environment (questions 7 vs 8); and wildlife conservation in general (questions 9 vs 10) before and after placement. A Kruskal-Wallis H test was used to assess the effect of prior experience and interest on the extent of change of these pairs. Statistical analysis was carried out using GNU PSPP 1.0.1 (Free Software Foundation, Boston, USA). Level of statistical significance was set at $p < 0.05$.

135 This study was approved by the Ethics Clinical Review Panel of the University of Nottingham, School of Veterinary Medicine and Science.

Results

140 A total of 200 out of 227 students completed the post-placement feedback survey, resulting in an 88% survey response rate.

As data were not normally distributed, they are presented as median (range) and non-parametric statistical tests were applied as described earlier.

Interest and experience in zoological medicine

145 More than one third (36.5%) of the students reported no (score 1 out of 5; n=18) or minimal (score 2; n=55) prior interest in a career in zoological medicine, while 31.5% had average and 32% had above average or high interest. The median interest was 3 (range=1-5).

Over two thirds of the students (68%) reported no or minimal prior experience in zoological medicine. 19% reported moderate experience, while 13% reported above average experience
150 in this field. The median experience level was 2 (range=1-5). A Chi-square test of independence showed a significant relationship between these two variables $X^2(16, n=200) = 70.46, p < .001$. Students with lower levels of interest were less likely to have had prior experience in zoological medicine when compared with students with higher levels of interest in the field.

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Knowledge about the work and role of modern zoos and zoo veterinarians

Approximately one third of the students self-reported no (n=13) or minimal (n=54) knowledge about the work and role of modern zoos prior to the placement, while 25% reported good (n=41) or excellent (n=9) knowledge (median=3, range=1-5). After the
160 placement, no students rated their knowledge as 'none' and only a single student reported their knowledge to still be minimal. 92.5% of students rated their post-placement knowledge as good (n=120) or excellent (n=65) (median=4, range=2-5). 15.5% of the students reported no change in their knowledge after versus before the placement. The score increased by one point among 44.5%, two points in 30.5% and by three score points in 9.5% of students. The
165 median change in knowledge from pre- to post-placement was 1 scale point. This change was statistically significant using a Wilcoxon signed-ranks test, $Z=11.56, p < .001$.

More than half (59%) of the students self-reported no (n=36) or minimal (n=82) knowledge about the work and role of veterinarians within a zoo prior to the placement, while 16.5% reported good (n=28) or excellent (n=5) knowledge (median=2, range=1-5). Following the
170 placement, no students rated their knowledge as none or minimal, and 95% rated it as being good (n=97) or excellent (n=93) (median=4, range=3-5). 6.5% of the students reported their knowledge score to be unchanged by the placement, while 27.5% reported their knowledge score to have increased by one, 35.5% by two, 21% by three and 9.5% by four scale points. The median change was 2 (range=0-4). This change was statistically significant using a
175 Wilcoxon signed-ranks test, $Z=12, p < .001$.

Attitude towards wildlife conservation

Only 6.5% of the students reported that, prior to the placement, they had no (n=1) or minimal (n=12) interest in wildlife conservation, while 72.5% reported themselves to be passionate
180 (n=83) or very passionate (n=62) about conservation (median=4, range=1-5). After the placement, no student rated their interest as none or minimal and 91.5% rated themselves as passionate (n=89) or very passionate (n=94) about wildlife conservation (median=4, range=3-5). The interest of 65% of the students were unchanged, while 28.5%, 5.5% and 0.5% increased their rating by one, two, and three points, respectively. The median change was 0
185 (range=0-3), however this change was still statistically significant (Wilcoxon signed-ranks test, $Z=7.78, p < .001$).

Opinion about zoos

More than half (n=112; 56%) of the students had unchanged opinions about zoos after the
190 placement, or did not provide an answer for question 5 (n=5, 2.5%). 43% (n=86) indicated positive change in their opinion and only 1% (n=2) indicated negative change. The relation

between the change in opinion regarding zoos and prior experience ($X^2(8, N=200)=12.54$, $p=.129$) or interest ($X^2(8, N=200)=9.47$, $p=.305$) were not statistically significant.

195 *Effect of prior experience and interest on scoring*

A Kruskal-Wallis H test was used to assess the effect of pre-placement experience and interest in zoological medicine on the scores students provided for questions 5 to 10, and to assess their effect on the degree of change between pre- vs post-placement ratings. The results are shown in Table 2. Prior experience had a significant effect on all ratings, except the post-placement ratings of the knowledge about zoo veterinarian work (question 8) and general attitude towards conservation (question 10). Prior interest had a significant effect on all ratings, except the post-placement rating of the knowledge about zoo veterinarian work (question 8). Students with less experience and/or limited interest were more likely to give lower scores and, in their case, a pre- vs post-placement change both was more likely and greater in magnitude.

Discussion

Zoo-based veterinary training programmes can have high financial and resource implications, and so it is important to evaluate and recognise the benefits they can offer. The potential benefits of these programmes include introducing students to this aspect of zoological medicine, providing them with opportunities to develop their transferable clinical and professional skills and enhancing their understanding of the work of modern zoological institutions and the veterinarians working within them. We hereby present preliminary data to highlight the positive value of providing zoo-based training to the next generation of veterinary professionals, regardless of their intentions to pursue a career in the field of zoological medicine.

Knowledge about the work and role of modern zoos and zoo veterinarians

Around two thirds of the participants reported moderate to very high levels of interest in pursuing a career in zoological or exotic medicine. However, 59% of the participants reported minimal or no knowledge about the work and role of zoo veterinarians prior to the placement, and more than two thirds reported having minimal or no prior experience within this field. Though the training provided by this placement was not sufficient to equip students with all the skills and knowledge needed to progress straight into veterinary career in zoological medicine, our findings highlight its value in providing students with early experiences in this field, and demonstrating the diversity of options available to them, post-qualification.

Attitude towards wildlife conservation

Our findings were also suggestive that, even short term, immersive placements in zoos, might be able to influence the opinions of undergraduate veterinary students about wildlife conservation. The percentage of students who reported themselves to be passionate or very passionate about conservation increased significantly pre- to post-placement (from 72.5% to 91.5%). Furthermore, the 6.5% of the students who reported they had no or minimal prior interest in wildlife conservation, reported at least moderate levels of interest after their placement. Since conservation education is one of the main roles of modern zoos **WAZA REF**, these findings might encourage zoos to engage more with higher education institutions. However it is important to note that, from our study alone, it is not possible to determine how long lasting this effect might be. Nonetheless, our findings are enough to suggest that their

240 experience will, at very least, have readied students to engage in more well-informed discussions with others in society, on the topic of wildlife conservation.

Opinion about zoos

245 As societal awareness about animal welfare issues continues to increase, so too does the amount of criticism zoos receive for keeping wild animals in human care.⁹ It was evident from our findings, that some of the ethical concerns of the general public about zoos were also shared by the participants of this study. However, we also presented evidence to suggest that even a short, but immersive and experiential zoo-based clinical placement can have a positive impact on final year veterinary students' self-reported understanding about the work of modern zoos and indeed their opinions on zoos in general. If further research were to show 250 this impact to persist long-term, it may suggest that implementing immersive training opportunities in similar institutions elsewhere could help ensure that the veterinary profession is engaged and supportive towards the zoo and aquarium community in the future.

Effect of prior experience and interest on scoring

255 We analysed the effect that students' prior interest and experience in zoological medicine played in acting as a confounding factor in their reported attitudes and opinions. It would be predicted that the responses of those students with higher interest and/or experience within the field prior to the placement would differ from those with limited interest or experience. Indeed, this was the case, with students reporting higher prior interest and/or experience 260 giving higher scores on questions regarding their understanding about modern zoos, veterinary work within zoos and wildlife conservation. Nonetheless, it was evident from our findings that the placement was still of value, having a significant effect on all students, and especially among those with limited prior interest or experience.

Limitations of the study

265 We acknowledge that this, as any study, has its limitations. Firstly, there might have been some influence on responses (and specifically a tendency to score more positively) due to social desirability bias (coming from staff and/or peers). Attempts were made to minimise this by making the survey anonymous and voluntary, and ensuring that the students were not 270 supervised during survey completion. It is possible, however, that the students were able to see the responses being made by their peers. Furthermore, given the small number (2-3) of students who completed the survey each week, the students may not have had confidence that their responses were entirely anonymous. Any changes in student knowledge were also self-reported rather than tested; utilising a short pre- and post-placement assessment would have allowed this to be objectively, and likely more reliably, measured. Additionally, there were also potentially slight changes between the different groups of students with regards to their training experience. This was due to the nature of the placement, which due to its experiential and immersive nature, gave staff very limited control over the caseload. Data relating to the caseload experienced by each group of students were not analysed but could be an interesting 280 variable to explore as part of ongoing investigations.

Given that the median score for many of the questions was 3 (out of 5), the scale used might have lacked some sensitivity regarding identifying subtle differences in student knowledge and opinion. This is especially true of the more complex issues covered, such as student attitudes towards wildlife conservation, for which a 5-point response scale is too simplistic to 285 gather the variety of attitudes and opinions likely to be held by a diverse group of individuals. In this vein, it should also be noted that, whilst quantitative scores (1-5) were used, the

intervals between them (i.e. 2 to 3, versus 3 to 4) may not have been equal or deciphered differently between individuals. This limitation of the survey design can be attributed to the fact that the survey was initially intended to collect student responses for internal quality control purposes, and only subsequently used for research. As personal data, including age, gender or nationality, were not collected, it was not possible to analyse the effect these factors had on student responses.

Finally, whilst this study demonstrates significant change in opinion, it is not known whether this also equates to participant behaviour change, and so our data cannot be taken as direct evidence that those students who indicated a more positive opinion about wildlife conservation or zoos will actually change their behaviour accordingly.

Future implications for the placement

The findings of this survey are suggestive that the placement achieved one of its key aims in enhancing students' awareness about the work of modern zoological institutions and veterinarians working within them. If, however, the primary goal of the placement is to expose students to the diversity of career options available to them post-graduation, it might be argued that such an experience would be better suited to earlier in their curriculum. This is further substantiated by our finding that students with higher level of interest of a career in zoological medicine, typically already had gained experience in this field. Furthermore, given that so few individuals will ultimately pursue a career in zoological medicine, the need for all veterinary graduates to have an awareness of the role of a zoo veterinarian should also be called into question. Veterinary schools may instead therefore choose to offer these opportunities on an elective (opt-in) basis and indeed, this is the route that the University of Nottingham has taken since the end of this study.

Conclusions

The findings of this study suggest that the 5-day compulsory placement at Twycross Zoo has been effective in providing a positive educational experience for undergraduate veterinary students from the University of Nottingham. Self-reported scores of understanding the work of modern zoos, zoo veterinarians and affinity towards wildlife conservation changed positively post vs pre-placement regardless of prior interest or experience, but more so in individuals with limited prior interest and/or experience. Further work is needed to establish whether these findings can be extrapolated to other institutions, and whether the effects are long lasting. If further substantiated, the findings might support the development of similar practical and immersive training programmes for veterinary undergraduates, in zoos elsewhere, and therefore enhance the current offering regarding practical training in zoological medicine.

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390 Table 1. - Summary of the questions of the survey filled out by veterinary students at the end of their five day long zoo placement. The questionnaire was anonymous and the students were not supervised while filling it out. No personal data were collected due to the small group setting. 5 point numeric scales were represented as 1-5, where 1 means least positive/lowest, while 5 means most positive/highest.

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Number	Question	Answer option	Guidance given to students
1	What is your level of interest in a career in zoo/exotic medicine?	5 point numeric scale	1 = No interest at all 5 = Very interested
2	How much prior experience do you have in the field of zoo/exotic work (clinical or otherwise)?	5 point numeric scale	1 = No experience at all 5 = Lots of experience
3	Think about your opinion how you felt about zoos before your placement. Please write a few brief words about these thoughts.	Free text	
4	Have your opinion about zoos changed during the course of this week? If yes, how have they changed?	Yes/no If yes, free text	
5	Before your zoo placement, how much did you know about the work and role of a modern zoo?	5 point numeric scale	1 = No prior knowledge 5 = Already knew a great deal
6	At the end of your zoo placement, how much do you know about the work and role of a modern zoo?	5 point numeric scale	1 = Nothing at all 5 = A lot
7	Before your zoo placement, how much did you know about the work and role of a vet within a zoo environment?	5 point numeric scale	1 = No prior knowledge 5 = Already knew a great deal
8	At the end of your zoo placement, how much do you know about the work and role of a vet within a zoo environment?	5 point numeric scale	1 = Nothing at all 5 = A lot
9	Before your zoo placement, how much did you care about wild animal conservation?	5 point numeric scale	1 = Did not care at all 5 = Very passionate
10	At the end of your zoo placement, how much do you care about wild animal conservation?	5 point numeric scale	1 = Still do not care at all 5 = Very passionate

Table 2. Effect of pre-placement experience and interest in zoological medicine on the ratings for questions 5 to 10 and to their effect on the change between pre- vs post-placement ratings. Results of Kruskal-Wallis H test. * marks significant difference

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Question number	Question	Experience			Interest		
		X ²	df	p	X ²	df	p
5	Before your zoo placement, how much did you know about the work and role of a modern zoo?	58.52	4	<.001*	24.95	4	<.001*
6	At the end of your zoo placement, how much do you know about the work and role of a modern zoo?	21.12	4	<.001*	11.08	4	0.026*
7	Before your zoo placement, how much did you know about the work and role of a vet within a zoo environment?	40.6	4	<.001*	37.26	4	<.001*
8	At the end of your zoo placement, how much do you know about the work and role of a vet within a zoo environment?	8.18	4	0.085	7.18	4	0.127
9	Before your zoo placement, how much did you care about wild animal conservation?	21.98	4	<.001*	36.83	4	<.001*
10	At the end of your zoo placement, how much do you care about wild animal conservation?	9.25	4	0.055	27.35	4	<.001*
5 vs 6	Change in the students' knowledge about the work and role of a modern zoo pre- vs. post-placement	35.76	4	<.001*	17.44	4	0.002*
7 vs 8	Change in the students' knowledge about the work and role of a vet within a zoo environment pre- vs. post-placement	29.79	4	<.001*	29.83	4	<.001*
9 vs 10	Change in the students' attitude towards wild animal conservation pre- vs. post-placement	16.15	4	0.003*	13.37	4	0.01*