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Research article

Profiling and comparing participants of online and on-site educational programmes: Case study of the symposium on giant salamander in Hiroshima City Asa Zoological Park, Japan

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Abstract

One mission of modern zoos is to serve as a facility for environmental education. Evaluation and improvement of zoo educational programmes is an important process in achieving this mission. Understanding participants' characteristics will help deliver educational messages more effectively and improve programmes. Since the COVID-19 pandemic, many zoos are exploring the possibility of shifting programmes online; however, profiling reports of participants are limited. This study conducted questionnaire surveys and compared the profiles of participants in a Japanese giant salamander symposium held annually since 2014 at Hiroshima City Asa Zoological Park (Asa Zoo) in Japan. The symposium was held four times on-site, once online and once in hybrid format. The online symposium was attended by significantly more first-time participants from distant locations than the on-site format. Online participants included people who had never visited Asa Zoo and some repeat local visitors. These results indicate that online programmes could grant an alternative option to citizens who seldom visit the zoo. However, solely offering such programmes online could create a participation barrier for local citizens who are unfamiliar with online tools. Online participants preferred to attend repeat programmes using the online format. This outcome suggests that online programmes are less effective in encouraging people to visit the zoo. Thus, the present study reveals online programmes' ability to attract new educational targets for zoos; however, it also underscores the importance of hosting on-site or hybrid programmes. Online educational programmes must be used and evaluated in light of their objectives and target audiences to further develop zoo-related educational activities.

Introduction

One of the missions of modern zoos is to serve as a facility for environmental education (Thomas 2020). Zoos focusing on conservation education can entertain visitors and simultaneously increase public knowledge, thereby enhancing interest in global conservation (Schilbert and Scheersoi 2022). Several studies have demonstrated that repeat visitors could increasingly become positive about conservation (Lukas and Ross 2005; Yalowitz 2004). Hence, attracting the public to visit zoos through high-quality educational programmes is essential. As evaluating the effectiveness of educational activities can lead to programme improvements, many studies have assessed visitors' knowledge, attitudes and behaviours towards animals or the environment (Godinez and Fernandez 2019; Moss et al. 2017a; Nygren and Ojalammi 2018).

However, measuring learning and tracking behavioural changes is difficult because individuals with different background knowledge and attitudes process information and experiences attained during a zoo visit differently (Ballantyne et al. 2007; Moss and Esson 2013). For example, Davidson et al. (2010) indicated that the learning occurring on student field trips depends more on the sociocultural context of the classroom or friends than it does on the agendas adopted by

zoo educators. Other studies have also evidenced that factors such as residence and other demographic features correlate more closely with the conservation behaviours of visitors than knowledge does (Moss et al. 2017b). Therefore, programmes must first be ameliorated through a detailed comprehension of visitor-participant characteristics, which would enable the zoo to effectively deliver conservation-related messages to target citizens (Mann 2020).

New educational programmes using online tools have increased in recent years. The COVID-19 pandemic forced the temporary closure of many facilities. Zoos were unable to provide visitors with a direct experience, which prompted a shift to online educational programmes (Thomas 2020). These programmes range from synchronous educational programmes, such as live streaming and webinars, to asynchronous programmes that utilise social media (Llewellyn and Rose 2021; Thomas 2020). Although online education programmes could be an important activity for zoos going forward, studies evaluating their effectiveness remain limited. Cozens-Keeble et al. (2021) assessed an online summer school newly launched by Edinburgh Zoo and reported that participation was higher for the online real-time sessions than for recorded content. Nonetheless, online education represents an entirely different environment from on-site educational programmes specific to the zoo environment (Schilbert and Scheersoi 2022). Comprehension of the characteristics of online education requires a comparison of online and on-site participants, as well as an appraisal of multiple online formats. Thus, profiling the participants of both online and on-site programmes to understand their characteristics and the content that can attract them is critical.

The Japanese giant salamander (JGS; *Andrias japonicus*) is one of the largest amphibians in the world and has been designated a vulnerable endemic species in Japan (IUCN SSC Amphibian Specialist Group 2022). Declining domestic JGS populations and hybridisation with alien species from China have been reported in recent years; conservation strategies are thus being considered (Fukumoto et al. 2015; Yoshikawa et al. 2011). Hiroshima City Asa Zoological Park (Asa Zoo) has continued field surveys and conservation activities for the JGS. Asa Zoo is the only facility in the world that has successfully bred and maintained multi-generational captive populations (Kuwabara et al. 1989). It does not employ full-time research staff as in many zoos in Japan (Anzai et al. 2022). Instead, the zoo has contributed to understanding JGS ecology by conducting collaborative studies in various fields with external researchers on both dead specimens and captive individuals (Bletz et al. 2017; Ishikawa et al. 2021). To promote these results and the importance of JGS conservation, the zoo has held an annual symposium since 2014. The symposium is entitled 'The Collaborative Research Symposium of Japanese Giant Salamander' and the primary target audience is teenage individuals and older. The zoo staff introduce the ecology of the JGS and the conservation activities of the zoo followed by an interpretation of the latest research by the co-researchers. The symposium has been held at the zoo annually from 2014 to 2019 but was cancelled in 2020 due to the pandemic. The seventh symposium was held online in 2021, and the eighth was held hybrid-style, both on-site and online, in 2022 (Table 1). Thus, these symposiums are a valuable case study that enables evaluation of the effect of online factors by comparing the efficiency of both formats.

In this study, visitors to the on-site and online versions of the same symposium were compared through a questionnaire survey that collected information on visitors' characteristics. Additionally, the study examines how zoos should utilise online educational programmes by assessing online participants' interest in visiting the zoo.

Materials and methods

The Collaborative Research Symposium of Japanese Giant Salamander

The symposium was held for the first time on 12 October 2014. On-site symposiums were held once per year at a hall in Asa Zoo, where two or three guest researchers were invited to present each time. They presented their research findings after zoo staff had explained JGS conservation efforts. In total, the symposiums were held six times from 2014 to 2019 (Table 1). In all cases, no registration was required and no participation fee was charged apart from an entrance fee to the zoo. Announcements were made using the following media: flyers (Figure 1; distributed to schools and public information magazines in Hiroshima City), the official websites of Asa Zoo and the Japanese Association of

Table 1. Overview of the seven symposiums: all sessions consisted of an introduction from Asa Zoo staff and two or three presentations from external researchers.

Session	Format	Survey	Date	Subjects of external researchers
2014	On-site		Sunday 12 October 2014	Population genetics, age determination, breeding success
2015	On-site		Sunday 24 January 2016	Cutaneous symbiotic bacteria, estimating colour vision, odour analysis of mucus
2016	On-site	Yes	Sunday 6 November 2016	Sex discrimination, observation of nest cleaning, morphological evolution of skull
2017	On-site	Yes	Saturday 16 December 2017	Histology of limb bone, parent-offspring judgment, hormonal reproduction study
2018	On-site	Yes	Sunday 11 November 2018	Indoor breeding success, cranial morphometrics
2019	On-site	Yes	Sunday 10 November 2019	Detection of spawning by environmental DNA, population genomics
2021	Online	Yes	Saturday 27 November 2021	Cranial skeletogenesis, sex discrimination and sex ratio
2022	Hybrid	Yes	Sunday 16 October 2022	Hybridisation with Chinese species in Kyoto, Mie, Hiroshima Prefecture

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Zoos and Aquariums, the official Twitter account of Asa Zoo and academic mailing lists (for members of the Ecological Society of Japan, Society of Evolutionary Studies Japan and Japanese Giant Salamander Society). These on-site symposiums presented three or four lectures and panel discussions followed by a behind-the-scenes tour for a total of 3 hr.

On 27 November 2021 the seventh session was conducted online using a webinar on Zoom (Zoom Video Communications, Inc.). Two external researchers did not come to the zoo and instead spoke online. Flyers were not distributed but the symposium was announced on the zoo's website, Twitter account and mailing list, because it was an online symposium. Pre-registration was required, which was scheduled from 1 to 27 November 2021, using the link from the official website of Asa Zoo. Participation was free but participants were required to register for a Zoom account using their name and e-mail address. This online symposium included three lectures and one question and answer session, which lasted for 2.5 hr.

A hybrid-format symposium via a Zoom webinar and YouTube live streaming was hosted at the Asa Zoo hall on 16 October 2022. Two of the three external researchers spoke at the hall and the other presenter appeared online. Announcements were disseminated as for previous on-site symposiums via flyers, the official website, Twitter and mailing lists. Zoom participants were required to pre-register, but on-site participants and YouTube viewers did not need registration. In all cases, participation was free.

Questionnaire survey

Surveys were not conducted for the 2014 and 2015 symposiums. Thus, the study used the results of the 2016 and subsequent symposiums. Each participant was handed a questionnaire upon entering the hall and requested to submit it upon leaving. In the 2021 online symposium, participants were asked to answer a web-form questionnaire after the symposium. On-site participants for the 2022 symposium were asked to submit a distributed questionnaire, and their online counterparts were, as in the past, asked to answer a web-form questionnaire displayed after the symposium. All questionnaires were collected anonymously and voluntarily, and their responses were managed in a way that did not disadvantage any participant. It was noted on the survey form (for on-site participants) or web form (for online) that responses would only be used for research analysis and to improve the symposium.

Table 2 provides a list of the questionnaire items. In terms of professional categories, 'students' indicated children attending primary and secondary school, generally aged 6–18 in Japan; 'other public' alluded to general citizens excluding professionals related to the symposium theme, such as researchers or zoo and aquarium personnel. A free comment section was also provided in the questionnaire.

Data analysis

For each question common to on-site and online symposiums (A–E in Table 2), the response rate for all participants was compared

Figure 1. Example of flyers publicising the symposium in 2016 (left) and 2019 (right).

Table 2. Details of the questionnaire survey content. *This also included graduate schools and technical colleges. SA: single answer, MA: multiple answers

	Content	Style	Sessions	Choices
A	Age	SA	all	0-9 years; 10–19; 20–29; 30–39; 40–49; 50–59; 60+
B	Profession	SA	all	Students; university or college*; zoo or aquarium staff; researchers; other public
C	Residence	SA	all	Hiroshima Prefecture; other prefectures
D	How many times have you joined this symposium?	SA	all	First time; second time; third time or more
E	How did you find out about this symposium?	MA	all	Flyers; Asa Zoo official website; mailing lists; non-Asa Zoo websites; through an acquaintance
F	Would you like to attend the next symposium?	SA	2021, 2022	Want to attend on-site; want to attend in any form; want to attend if online; do not want to attend
G	How many times have you visited Asa Zoo?	SA	2022	Never; once; 2 or 3 times; 4 to 9 times; 10 times or more
H	How many people did you watch with?	number	2022	

among on-site and online sessions. Chi-square tests (2×6) were conducted on the number of responses (excluding no answer) in each of the six sessions at a significance level of $P<0.05$. Multiple comparisons were performed using levels adjusted by the Bonferroni method to examine whether any rate was significantly biased against other sessions. For the 2022 answers, 2×3 chi-square tests and multiple comparisons were similarly conducted among the three ways of participation. Statistical analysis was performed using R (4.2.1, R Foundation for Statistical Computing, Vienna, Austria). Online participants' interest in attending the symposium and visiting the zoo was evaluated by comparing their answers to questions F to H in Table 2 among their attendance methods or residence. Free comments were categorised and compared by session.

Results

Comparison of on-site and online participants

The study collected responses from 408 participants from the six symposiums. Table 3 summarises the number of responses to questions about age, profession, residence and participation experience. Online 2021 was attended by a significantly lower proportion of teens (3%). The hybrid 2022 attracted more participants in their 50s (32%) and more than half attended via Zoom. Nine students attended in 2022; their numbers were not lower than in other years but the rate of students attending the 2021 (3%) and 2022 (9%) online sessions was lower than that of on-site enrolments. Researchers and environmental conservation groups tended to participate more via Zoom than they did on-site. Among the four on-site sessions, there were more teenagers (34%) and students (37%) in 2017, but no common trend was observed.

Most participants attending the four on-site sessions resided in Hiroshima Prefecture. In 2021 and 2022, an increasing number of participants resided outside the prefecture, and significantly fewer Hiroshima residents participated in 2021 (25%). In 2022, more Hiroshima residents participated on-site and participants from outside the prefecture preferred to attend through Zoom.

The 2022 symposium registered 56 first-time attendees, second only to 2017. Nevertheless, 2022 recorded the lowest percentage of first-time attendees vis-à-vis the total number of participants (56%). Comparison of the ratio of first-time attendees at each session by place of residence reveals that Hiroshima residents formed a majority of the attendees at on-site sessions (Table 4). Conversely, 42 of 48 first-time attendees of the online 2021 symposiums resided outside the prefecture. In comparison, 18 of 22 first-time on-site participants of the hybrid 2022 symposium were Hiroshima residents, and 25 of 34 first-time online participants lived outside the prefecture.

Comparing how participants came to know about the symposium (Table 5), a significantly higher rate of participants in 2021 and 2022 became aware through mailing lists and non-Asa Zoo websites. Additionally, a higher rate in 2022 found out about the symposium through the official website. On the other hand, fewer participants came to know about the symposium through flyers or schools. A respondent in 2016 and 2017 and four in 2022 answered that they discovered the symposium after they visited the zoo.

More than half of the free comment sections were left blank (234/406, Table 6). Most comments articulated opinions on the content of presentations, e.g. 'fascinating', 'want to know more about wild ecology'. For four on-site sessions, requests were made for the symposium to be held outside of Hiroshima and for the sale of JGS merchandise, and personal views were expressed about the symposium schedule (more breaks, more extended general discussion) and the zoo exhibit (want to see JGS juveniles, larger tanks). The comments recorded in 2021 and 2022 expressed appreciation for the online symposium and articulated hopes for its continuation, often citing as reasons the difficulties of on-site participation posed by distance for residents far from the zoo. However, other justifications also existed, for instance, children being young or suffering from a physical disability. The 2022 YouTube participants expressed a preference for this channel because it was easy to use and did not require registration. Some dissatisfaction was registered with the online environment, such as difficulty hearing over the microphone and needing to open the chat function. Some requests for archives were also noted.

Online participants' interest in visiting the zoo

None of the respondents of the 2021 and 2022 sessions answered 'No' to the question probing whether they would like to attend the next symposium (Table 7). However, nearly half of the respondents in the 2021 symposium (online only) who marked that they were willing to participate in future symposiums also confirmed that they would attend 'if online'. This percentage was particularly

Table 3. Comparison of participant questionnaire responses (characteristics and experiences, Questions A–D), with disaggregated 2022 responses shaded. *Category was not in original choices but was extracted from 'other'. †Significantly smaller ratio than others (P<0.05 after Bonferroni adjustment). ††Significantly greater ratio than others.

		2016 On-site	2017 On-site	2018 On-site	2019 On-site	2021 Online	2022 Hybrid	2022 On-site	2022 Zoom	2022 YouTube
A: age	0–9	0	3	1	0	0	0	0	0	0
	10–19	1†	28††	7	12	2†	10	4	4	2
	20–29	10	21	12	8	18	13	4	4	5
	30–39	10††	4†	6	6	10	10	6	2	2
	40–49	12	14	17	14	13	20	6	8	6
	50–59	3	4†	7	10	12	32††	12	18††	2†
	60+	4	6	9	4	10	13	10	3	0
	No answer	2	2	2	4	0	2	1	1	0
	Total	42	82	61	58	65	100	43	40	17
B: profession	Student	1†	31††	8	11	2†	9†	4	3	2
	University or college	8	12	11	5	13	10	4	4	2
	Zoo or aquarium	0	0	0	0	2	7††	1	3	3
	Researcher	5	3	3	3	10††	9	1	8††	0
	Environmental organisation*	0	0	0	0	0	8††	0	7††	1
	Other public	27	36	38	38	37	56	32††	15†	9
	No answer	1	0	1	1	1	1	1	0	0
	Total	42	82	61	58	65	100	43	40	17
C: residence	Hiroshima	21	38	35	34	16†	51	34††	12†	5
	Other	9	11†	10†	12	49††	49††	9†	28††	12
	No answer	12	33	16	12	0	0	0	0	0
	Total	42	82	61	58	65	100	43	40	17
D: How many times participant has joined the symposium	First time	32	65††	35	33	48	56†	22	24	10
	Second time	8	7	12	12	8	23	7	11	5
	Third and more	2†	8	14	13	9	21	14††	5	2
	No answer	0	2	0	0	0	0	0	0	0
	Total	42	82	61	58	65	100	43	40	17

high among first-time participants living outside the prefecture. Only one respondent residing within the prefecture indicated the desire to participate on-site. After the 2022 session, 23 out of 100 respondents indicated that they would like to participate on-site at the next symposium, and 25 answered that they would participate if it was offered online. Those who preferred the on-site version were primarily residents of Hiroshima Prefecture or on-site participants. Conversely, those who preferred the online format were more likely to live outside Hiroshima or be online participants.

Table 4. Comparison of residence of first-time participants

	2016 On-site	2017 On-site	2018 On-site	2019 On-site	2021 Online	2022 Hybrid	2022 On-site	2022 Zoom	2022 YouTube
Hiroshima	14	27	20	17	6	27	18	8	1
Other	7	9	6	9	42	29	4	16	9
No answer	11	29	9	7	0	0	0	0	0
Total first-time participants	32	65	35	33	48	56	22	24	10
All participants	42	80	61	58	65	100	43	40	17

Table 5. Comparison of how participants found out about the symposium (Question E; total number of responses does not equal total participants due to use of multiple-choice question). *Category not in original choices but extracted from 'other'. †Significantly smaller ratio than others. ††Significantly greater ratio than others.

	2016	2017	2018	2019	2021	2022	2022	2022	2022
	On-site	On-site	On-site	On-site	Online	Hybrid	On-site	Zoom	YouTube
Flyers	9	28††	14	16	-	9†	5	1	3
Official website	11	5†	16	14	20	39††	19	12	8
Mailing lists	2	3†	1†	3†	20††	27††	7†	16††	4
Non-Asa Zoo websites	4	3†	3	2	14††	18††	7	10	1
Through acquaintance	14	32	26	21	23	23	7	13	3
Through school*	0	11††	0	5	0	3	0	1	2
On that day at the zoo*	1	1	0	0	0	4	4	0	0
Other	3	2	4	4	2	0	0	0	0
All participants	42	82	61	58	65	100	43	40	17

Of the 100 participants who attended the 2022 symposium, 21 had never visited Asa Zoo, 20 of whom lived outside the prefecture (Table 8). Two participants residing outside the prefecture visited the zoo for the first time. Online participants who had visited the zoo once before included one Hiroshima resident and eight people living outside the prefecture. Thirty-six participants had visited the zoo ten times or more, 30 of whom lived in Hiroshima Prefecture, with eight having participated online. YouTube participants living outside Hiroshima had visited the zoo less than twice, whereas many of the YouTube attendees who were Hiroshima residents frequently visited the zoo. Additionally, 60% of the 57 online participants watched the symposium alone, whereas the other 40% viewed it with others (Table 9). The most significant collaborative viewing involved 13 other people; thus, the online viewers totalled 102 in number.

Discussion

Advantages of holding online symposiums

The 2021 and 2022 symposiums were held using online tools and registered a significantly larger ratio of out-of-prefecture participants than the previous four on-site symposiums (Table 3). This included many first-time participants, attracting people who had never visited Asa Zoo (Table 8). Online tools proved to be an

Table 6. Comparison of free comments

	2016	2017	2018	2019	2021	2022	2022	2022	2022
Category of comments	On-site	On-site	On-site	On-site	Online	Hybrid	On-site	Zoom	YouTube
Appreciation of online style					13	7		5	2
Appreciation of hybrid style						5	3	2	
Appreciation of YouTube						4			4
Complaints about the streaming environment					1	4		2	2
Request for archived distribution			1		1	3		2	1
Request for holding the symposium outside Hiroshima			1	2					
Comments about symposium content	17	11	11	15	24	33	18	14	1
Comments about symposium schedule	2	4							
Comments about the zoo exhibition		2	2	2					
Requests for JGS merchandise sales	1	2	1	3					
No answer	22	61	45	36	26	44	22	15	7
Total	42	80	61	58	65	100	43	40	17

Table 7. Comparison of interest in participation in the next symposium (Question F) according to residence and participation style

	2021		2022							
Residence	Hiroshima	Other	Hiroshima				Other			
Attendance style	Zoom		Total	On-site	Zoom	YouTube	Total	On-site	Zoom	YouTube
Prefer to attend on-site	1	0	17	13	3	1	6	5	1	0
In any form	13	22	26	18	5	3	23	3	16	4
If online	2	27	6	1	4	1	19	0	11	8
Do not want to attend	0	0	0	0	0	0	0	0	0	0
No answer	0	0	2	2	0	0	1	1	0	0
Total	16	49	51	34	12	5	49	9	28	12

effective means for attracting new participants who are resident in distant areas and who are less likely to visit the zoo. On the other hand, some Hiroshima residents who had visited the zoo numerous times also participated online (Table 8). Online participants specifically indicated that they would like to participate in the next symposium if it was also offered online (Table 7). These results indicate that the online method would grant residents of distant and neighbouring areas more opportunities to participate in the symposium. However, participants attending the online symposium were not encouraged to visit the zoo in person. Hence, the educational message of the symposium can be communicated online, but another means is required to encourage participants to personally visit the zoo.

Online tools could expand or limit participation

The comparison of how participants discovered the symposium revealed that a significantly increasing number of participants in 2021 and 2022 attained their information through the website or via mailing lists. In 2022, more Zoom participants than on-site attendees came to know about the symposium through the mailing list (Table 5). Conversely, fewer participants in 2022 discovered the symposium through flyers, which were primarily distributed to schools and public facilities in Hiroshima Prefecture and were thus more likely to reach only local residents. Promotion through online tools tended to be more effective for the online programme which could be attended from distant locations. However, nine participants of the 2022 session found out about the symposium through flyers, and three were informed through schools in contrast to 2021, when no flyers were distributed. The distribution of flyers is probably necessary to encourage local citizens to participate, even though flyers are less effective than online methods.

Fewer teens, students and Hiroshima residents participated in the online 2021 symposium than in previous on-site symposiums (Table 3). Since their participation increased in hybrid 2022, the use of Zoom could have been a barrier to participation for young residents. Participants who viewed the programme on YouTube and thus did not need to pre-register praised the ease of

Table 8. Comparison of previous experience visiting Asa Zoo (Question G) for 2022 participants, categorised according to residence. * 'first' indicates an on-site participant visiting the zoo for the first time; once indicates online participant who has visited the zoo once before.

Residence	Hiroshima				Other			
Attendance style	Total	On-site	Zoom	YouTube	Total	On-site	Zoom	YouTube
Never visited Asa Zoo	1	-	1	0	20	-	11	9
First or once*	1	0	1	0	10	2	5	3
2 or 3 times	5	2	3	0	9	2	7	0
4 to 9 times	13	9	3	1	4	2	2	0
10 or more times	30	22	4	4	6	3	3	0
No answer	1	1	0	0	0	0	0	0
Total	51	34	12	5	49	9	28	12

Table 9. Comparison of the number of people viewing together online in 2022 (Question H), categorised according to residence

Residence	Hiroshima			Other		
Attendance style	Total	Zoom	YouTube	Total	Zoom	YouTube
Watched alone	10	8	2	25	16	9
Two people	4	2	2	9	7	2
Three people	3	2	1	2	1	1
Four people	0	0	0	2	2	0
Five people	0	0	0	1	1	0
Thirteen people	0	0	0	1	1	0
Total	17	12	5	40	28	12

participation (Table 6). Thus, unfamiliarity with Zoom or hesitance to register personal information could have deterred some youth from participating. In contrast, researchers, environmental organisations and people in their fifties were noted in 2022 as groups most likely to participate via Zoom. The barriers to Zoom participation may have been lower for individuals who used Zoom more frequently or even daily for work. However, the topics of the talks could also have exerted an impact on this outcome.

The COVID-19 pandemic caused online tools to become widespread in Japan. However, their penetration rates are lower in school education than they are in companies. Online tools are utilised less in rural areas, including Hiroshima, than in metropolitan areas (Ministry of Internal Affairs and Communications, Japan 2021). Schilbert and Scheersoi (2022) indicate that the familiarity of citizens with online tools could affect willingness to participate in online symposiums, notwithstanding interest in zoos and environmental conservation. Thus, changes will occur in the effectiveness of different methods of online education as online tools develop and gain popularity. Zoos must attend duly to technological advances and gauge public interest in them if they desire to engage in online education programmes.

How should online educational programmes be treated?

Although Japan has one of the highest levels of zoo and aquarium visitation globally (Davey 2007), many citizens prefer to visit local zoos instead of zoos outside their prefecture, due to a large number of facilities in Japan (Furusho and Moroi 2016). Online educational programmes offer a significant advantage because they allow institutions to transmit unique educational messages to distant citizens who do not frequently visit the institution's premises. However, online programmes are inadequate for encouraging participants from distant locations to visit a zoo. They are thus unsuited for marketing purposes and are more apt for the creation of unique educational content for people with limited experience of personally visiting a zoo.

Younger local citizens, a critical educational target for the zoo, could find it difficult to participate if the programme was only delivered online. However, the hybrid 2022 symposium registered a lower percentage of first-time participants; it attracted many repeat participants (Table 3). Such repeat participants included numerous Hiroshima residents, on-site visitors and individuals from the non-professional general public. Therefore, it would be better to arrange an on-site venue to attract repeat visitors to the programme. Some on-site participants discovered the symposium after visiting the zoo; therefore, residents could be encouraged to participate by expanding advance publicity and offering participation opportunities up to the day of the programme.

Accordingly, it is desirable to establish a hybrid style comprising on-site and online sessions to provide a broad audience with educational messages. However, some complaints were received from the online participants of the 2022 session about difficulties in hearing the microphone audio. The broadcasting equipment and environment at the zoo must thus be modified to achieve improved educational methods.

Evaluation of the educational effectiveness of online programmes is another issue for future researchers. The questionnaire was not initially designed for the present study; rather, it attempted to collect the opinions of symposium participants at a time when a global pandemic was not expected. Therefore, its design was inadequate for the current study and exhibited problems. For instance, numerous forms had answers left blank, the impact of lecture topics could not be quantitatively examined and responses before and after participation could not be compared. Additionally, the results from online participants revealed that some forms under a single account were jointly answered by more than one person (Table 8). More careful preparation and design are required to effectively assess whether the symposium transformed the knowledge and attitudes of respondents as numerous previous studies have attempted to accomplish (Moss and Esson 2013; Moss et al 2017a).

In the case of non-interactive programmes for many participants, such as symposiums, the messages participants receive online and on-site might not substantively differ. However, the educational effects of on-site and online programmes on participants could vary significantly when programmes involving presentations or interactions with animals or phenomena are interpreted. Miller et al. (2020) reported that participants who watched animal training exhibited improved awareness of nature conservation compared to those who watched videos of the animals being trained. It will be necessary to conduct similar analyses for variously-styled programmes to understand each format's characteristics and participation trends and to design appropriate educational programmes. Zoos must find effective ways to provide educational benefits by utilising online tools.

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Ethics Statement

As there was no ethics committee at the zoo where this study was conducted, it was carried out in compliance with the ethical codes of the British Psychological Society.

Conflict of Interest

The authors declare no conflict of interest.

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