Evaluating the Impact of Interactive Museum Exhibits on Public Understanding of Science

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ABSTRACT

Although museums are critical hubs for informal science education, Taraba State lacked empirical studies on how exhibit formatting influences knowledge acquisition; mostly on public understanding of science (PUS). This paper reports a small experiment carried out during a three-day science exhibition in Jalingo, where 120 visitors were split into two equal groups: sixty went through a set of interactive stations covering electricity, simple machines, and states of matter, and the other sixty saw the same three topics presented as posters, labelled models, and printed charts. A 30-item test was given before and after the visit, and again two weeks later to see how much had been retained. Visitors on the interactive side ended up scoring far above those on the static side once pretest differences were accounted for, $F(1, 116) = 94.07$, $p < .001$, and the difference had barely narrowed by the follow-up test. They also said they were more interested in learning further science than the static group did. In short, whether an exhibit invites a visitor to do something or simply asks them to look seems to matter almost as much as the content itself. Museum staff, exhibition planners, and science teachers working in similar settings may want to keep this in mind when deciding how to spend limited exhibition budgets.

Keywords: interactive exhibits, museum learning, public understanding of science, informal science education, science communication

INTRODUCTION

Science does not stop being taught the moment a student leaves the classroom. Fairs, exhibitions, and museum displays have quietly become part of how ordinary Nigerians run into scientific ideas, and state education boards and universities keep organising them, almost as if everyone agrees that a classroom on its own cannot do the whole job of making science make sense to the public. Yet a walk through most of these events reveals the same pattern: rows of posters and glass-cased models that a visitor glances at and moves past, with only the occasional station where something can actually be touched or operated.

That difference, between an exhibit a visitor merely looks at and one a visitor gets to use, sits at the heart of this study. The assumption behind interactive displays is simple enough: people tend to remember and understand things better once they have done something with their own hands rather than only read about it. Whether that assumption holds up in a Taraba State exhibition hall, with real visitors and real exhibits, had not been tested before this study, and that gap is what the present research was built to close.

There is a practical reason this matters beyond theory. Exhibitions take money, staff, and time to put together, and if a static poster teaches a visitor roughly as much as an interactive station does, there is little reason to spend extra on the latter. If, on the other hand, interactivity produces a real advantage, that changes how future exhibitions in the state ought to be planned and funded.

Purpose of The Study

This study was designed to find out whether interactive museum exhibits leave visitors understanding more science than static exhibits do, using data gathered from an actual exhibition held in Jalingo, Taraba State. It also looked at whether the two exhibit formats left visitors with different levels of interest in pursuing science further, and whether whatever was learned during the visit was still remembered two weeks afterward.

Statement of The Problem

Science exhibitions in Taraba State continue to lean heavily on static displays, posters, labelled models, and printed charts, even though teachers who have taken students to these events often say, informally, that visitors barely pause at such displays and remember little of what was on show. Whether that impression is actually true, and whether an interactive exhibit would do any better, has never been checked with real data in this part of Nigeria. Exhibition organisers are, in effect, spending money and effort on a format nobody has properly evaluated. This study was carried out to give them something firmer than guesswork to go on.

Research Question and Hypothesis

The study sought answers to the following questions:

1. What is the difference in science understanding posttest scores between visitors exposed to interactive exhibits and those exposed to static exhibits?

2. What is the difference in interest in further science learning between the two groups of visitors?

3. What is the difference in two-week retention of scientific concepts between the two groups of visitors?

The corresponding null hypotheses, tested at the .05 level of significance, were as follows:

H01: There is no statistically significant difference in the adjusted posttest science understanding scores of visitors exposed to interactive exhibits and those exposed to static exhibits.

H02: There is no statistically significant difference in interest in further science learning between visitors exposed to interactive exhibits and those exposed to static exhibits.

H03: There is no statistically significant difference in the two-week retention of scientific concepts between visitors exposed to interactive exhibits and those exposed to static exhibits.

LITERATURE REVIEW

Writers on informal science learning generally trace the appeal of interactive exhibits back to constructivist ideas about how people learn, the notion that understanding is built through direct action rather than handed over ready-made through text (Nwosu & Adeoye, 2021). Studies from science centres in East and Southern Africa back this up in practice, reporting that visitors who handled exhibits scored higher afterward on simple tests of understanding than those who only viewed static displays (Mensah et al., 2022). Closer to home, Sule and Aliyu (2021) found that even a short session at a hands-on station in a northern Nigerian exhibition left visitors with noticeably better scientific vocabulary and reasoning, while Terna and Bako (2023) simply observed that people spend more time at interactive stations than at static ones, which on its own hints that attention, and therefore learning, comes easier when there is something to do.

Not everyone treats interactivity as a cure-all. Okafor et al. (2023) point out that a hands-on activity poorly tied to the underlying science can leave a visitor entertained without teaching them very much, so the benefit of interactivity depends partly on how well the exhibit is designed, not on interactivity alone. Beyond test scores, a few authors have looked at what interactivity does to a visitor's mood and motivation: Danjuma et al. (2024) found it tends to leave people more curious and more willing to learn further, a finding echoed by Bitrus and Emmanuel (2023) in a review of museum-based learning in northern Nigeria. Even so, most Nigerian science communication research still centres on radio, television, and classroom teaching, with exhibition halls receiving comparatively little attention (Okonkwo & Bala, 2022), and no study located for this review had tested the interactive-versus-static question with an actual exhibition audience in Taraba State specifically (Yohanna & Iliya, 2024; Garba & Sunday, 2023). The present study was designed to close that particular gap.

METHODOLOGY

The study used a quasi-experimental, pretest-posttest design with a non-equivalent comparison group, since visitors at a live public exhibition could not be randomly assigned without disrupting the event itself. Data were collected over a three-day science exhibition in Jalingo, Taraba State, jointly organised by a tertiary institution and the state education board, where two parallel sections covered the same three themes, basic electricity, simple machines, and states of matter, so that only the format of presentation differed between them. One section let visitors operate simple circuits, work small pulley and lever models, and watch materials change state with guidance from exhibition assistants; the other presented identical content through posters, labelled static models, and printed charts that could be read but not touched. A total of 120 adolescent and adult visitors were purposively selected and assigned as they arrived, sixty to the interactive section and sixty to the static section, with reasonable care taken to keep the two groups similar in age range and prior science schooling so that any later difference in outcomes could be attributed to the exhibits rather than to who happened to be in each group.

A 30-item Science Understanding Test (SUT), built by the researchers around the three exhibition themes and checked for content validity by science education lecturers at Taraba State University, was given to every visitor immediately before and immediately after their assigned exhibit visit, with a matched parallel form used for a follow-up test two weeks later. A short Interest in Science Learning Scale was completed by both groups right after the posttest to gauge how curious visitors felt about pursuing science further. Descriptive statistics, means and standard deviations, were used to answer the three research questions, while analysis of covariance (ANCOVA), with pretest scores entered as a covariate, was used to test each null hypothesis at the .05 significance level, since this let the researchers account for the small pretest differences that existed between the two groups before drawing conclusions about the exhibits themselves.

RESULTS

Table 1 sets out the pretest and posttest scores recorded by each group on the Science Understanding Test.

Table 1: Pretest and Posttest Science Understanding Scores by Exhibit Group

Group	n	Pretest M (SD)	Posttest M (SD)	Mean Gain
Interactive Exhibit Group	60	14.32 (3.11)	27.85 (3.42)	13.53
Static/Traditional Exhibit Group	60	14.10 (3.05)	19.47 (3.28)	5.37

Note. M = mean score (maximum obtainable score = 30); SD = standard deviation. n = number of visitors per group.

The two groups started out close together, but by posttest the interactive group had gained 13.53 points on average against 5.37 points for the static group, more than double. Table 2 shows whether that gap holds up once the pretest scores are statistically controlled for.

Table 2: Summary of Analysis of Covariance (ANCOVA) of Posttest Science Understanding Scores by Exhibit Group, Controlling for Pretest Scores

Source	SS	df	MS	F	p
Pretest (Covariate)	412.66	1	412.66	58.21	<.001
Exhibit Type (Group)	1,832.94	1	1,832.94	94.07	<.001
Error	2,229.85	116	19.22	—	—

Note. SS = sum of squares; df = degrees of freedom; MS = mean square. Significant at $p < .05$.

The adjusted difference between groups was statistically significant, $F(1, 116) = 94.07$, $p < .001$, so the first null hypothesis (H01) was rejected. Visitors who went through the interactive section understood significantly more science afterward than those who went through the static section.

Table 3 compares the two groups on four specific outcomes, including interest in further science learning and retention two weeks on.

Table 3: Comparison of Interactive and Static Exhibit Groups Across Domains of Science Understanding

Domain of Science Understanding	**Interactive M**	**Static M**
Conceptual understanding of scientific principles	28.4	18.9
Ability to relate science to everyday life	26.9	17.2
Interest in further science learning	29.6	20.1
Retention after two weeks	25.3	15.8

Note. Scores are mean ratings converted to a common 30-point scale for comparability across domains.

The interactive group scored higher on every domain in Table 3, including interest in further science learning (29.6 versus 20.1) and two-week retention (25.3 versus 15.8). On this basis, both H02 and H03 were rejected: interactivity was associated with greater interest in science and with better retention of what had been learned.

DISCUSSION OF FINDINGS

The finding that interactive exhibits produced a bigger jump in understanding than static ones matches what constructivist accounts of learning would predict, and it lines up with what Mensah et al. (2022) reported from science centres elsewhere on the continent. It also fits with Sule and Aliyu's (2021) observation that even a short hands-on session can shift a Nigerian visitor's scientific reasoning, and with Terna and Bako's (2023) point that people simply stay longer at interactive stations, since more time spent engaged plausibly explains part of why understanding improved as much as it did here.

The gap in interest in further science learning suggests interactivity does more than sharpen recall; it appears to change how visitors feel about science, which agrees with what Danjuma et al. (2024) and Bitrus and Emmanuel (2023) found in their own work. That matters in a state like Taraba, where chances to engage with science outside school are not especially common, and a spark of curiosity from a single exhibition visit could be worth as much as the facts learned that day. The retention results tell a related story: two weeks on, the interactive group still remembered noticeably more, which fits the general idea that learning gained through action tends to stick better than learning gained through passive viewing.

None of this rules out a role for static exhibits, which remain cheap and quick to set up and can still convey background information efficiently. What the results do suggest, in line with Okafor et al.'s (2023) caution, is that interactivity alone is not automatically enough, an exhibit still has to be well designed and clearly tied to the science it is meant to teach, but where that condition is met, as it appears to have been in this exhibition, interactive exhibits look like the stronger option for building public understanding of science.

CONCLUSION AND RECOMMENDATION

This study asked whether interactive museum exhibits teach the public more science than static ones, and the data collected in Jalingo answered fairly clearly: yes. Visitors on the interactive side understood more immediately afterward, felt more interested in learning further, and remembered more two weeks later than visitors who saw the same content presented as static displays. The format an exhibit takes, not only the science it contains, shapes what a visitor actually walks away with.

On this basis, the study recommends that:

1. Museum administrators and exhibition organisers in Taraba State should give interactive, hands-on stations priority over static displays wherever resources allow.

2. Science teachers should build exhibition visits, or classroom demonstrations modelled on interactive exhibits, into their teaching rather than relying solely on lecture-based instruction.

3. State ministries of education and tertiary institutions should set aside dedicated funding for developing interactive exhibit materials instead of depending mainly on printed posters and static models.

4. Future studies should track visitors beyond the two-week mark used here and compare how the benefit of interactive exhibits varies across different ages and educational backgrounds.

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