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Evaluating the Impact of a Science Night Outreach Event on Public Attitudes toward Science, Scientific Self-Efficacy, and Behavioral Intentions

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Abstract

Background: Public engagement with science supports scientific literacy and strengthens connections between science and society. Outreach events provide accessible opportunities to foster interest in science and sustained engagement. This study aimed to evaluate attendees' perceptions of a Science Night outreach event and its association with attitudes toward science, scientific self-efficacy, and future behavioral intentions.

Materials and Methods: This applied, descriptive-analytical, cross-sectional study surveyed attendees of a Science Night event in Kerman, Iran, on June 10, 2026. Data were collected with a researcher-developed questionnaire containing demographic items and 14 Likert-scale statements. Content validity was assessed using the Content Validity Ratio (CVR) and Content Validity Index (CVI), and internal consistency was measured using Cronbach's alpha. Data were analyzed in SPSS using descriptive statistics, independent-samples t-tests, and one-way ANOVA; $p < 0.05$ was considered significant.

Results: Of the 200 participants, 57% were female. Mean scores were highest for Event Evaluation (4.04 ± 0.71), followed by Behavioral Intention (3.91 ± 0.93), Attitude toward Science (3.86 ± 0.90), and Scientific Self-Efficacy (3.80 ± 0.89). Willingness to recommend the event (4.21 ± 1.04) and presenter clarity (4.13 ± 0.86) received the highest item scores. No significant gender differences were found. However, participant role significantly influenced Event Evaluation ($p = 0.037$), Attitude toward Science ($p < 0.001$), and Scientific Self-Efficacy ($p = 0.042$), with the general public scoring higher than students. Educational level also affected Event Evaluation ($p = 0.047$) and Attitude toward Science ($p = 0.003$).

Conclusion: Science Night attendance was associated with favorable evaluations, positive attitudes toward science, stronger self-efficacy, and greater behavioral intentions, suggesting that interactive public science events can strengthen science communication and public engagement.

Key Words: Attitude toward science, Behavioral intention, Science communication, Scientific self-efficacy.

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1- INTRODUCTION

In knowledge-based societies, public engagement with science is increasingly recognized as a key strategy for enhancing scientific literacy and fostering informed citizenship (1, 2). Although formal education systems play a central role in developing scientific knowledge, they are often limited in their ability to sustain long-term interest or to meaningfully connect scientific concepts with everyday life (3, 4). As a result, schools alone may be insufficient to cultivate enduring engagement with science, underscoring the importance of complementary informal learning environments (1, 4).

Informal science settings—such as museums, science festivals, and public outreach events—offer flexible, interactive, and participatory opportunities for engaging with scientific ideas (1, 5, 6). These environments facilitate the integration of cognitive, emotional, and social dimensions of learning in ways that formal settings may not fully support (1, 4). Within this context, the concept of *science capital* is particularly relevant, highlighting how individuals' engagement with science is shaped by their knowledge, social resources, and dispositions (7). Public outreach initiatives, including Science Nights, aim to reduce the perceived distance between researchers and the public while emphasizing the societal relevance of scientific research (8, 9).

Despite the increasing popularity of such initiatives, their evaluation remains limited. Success is often measured using attendance figures rather than systematic assessment of participants' attitudes, perceptions, and intentions for future engagement (2, 9). Furthermore, participation in science outreach activities may be socially patterned, raising concerns about equitable access and inclusivity (10, 12). To better understand the impact of these initiatives, it is essential to assess psychosocial outcomes (2, 6, 9). In particular, science-related self-efficacy—defined as an individual's belief in their ability to understand and engage with scientific concepts—may play a critical role in shaping future engagement (11). Therefore, more rigorous, outcome-oriented evaluations are needed to determine how informal science-learning experiences influence public attitudes, self-efficacy, and behavioral intentions (2, 12).

Accordingly, the present study aimed to evaluate participants' experiences of a Science Night outreach event and to assess their attitudes toward science, science-related self-efficacy, and intentions for future engagement.

2- MATERIALS AND METHODS

2-1. Study Design and Setting

This study employed a cross-sectional, descriptive-analytical design to assess the impact of a Science Night event on participants' attitudes and scientific engagement. Data were collected using a structured questionnaire administered during the event, held on June 10, 2026, in Kerman, Iran. This design was appropriate for capturing participants' attitudes and perceptions at a single time point within a naturalistic setting (13).

2-2. Participants and Sampling

The target population comprised all visitors attending the Science Night event. Due to the spontaneous nature of the event and the practical constraints of the field environment, a non-probability convenience sampling method was utilized (14). Although convenience sampling is subject to selection bias, it remains a widely accepted and practical approach in large-scale public outreach research where the population is transient and access to a comprehensive sampling frame is not feasible (15).

The inclusion criteria were: (a) physical attendance at the event, (b) voluntary consent to participate, and (c) completion of the questionnaire. Respondents who submitted incomplete questionnaires (defined as having more than 20% of the data missing) or withdrew during the process were excluded from the analysis.

2-3. Sample Size Calculation

The required sample size was estimated using Cochran's formula for finite populations. For an initial infinite population, the sample size n0 was calculated assuming a 95% confidence level (Z=1.96), a margin of error of d=0.05, and maximum variability (p=0.5, q=0.5):

$$n_0 = \frac{Z^2 pq}{d^2}$$

Given an estimated population size of approximately n=500 attendees, the finite population correction was applied:

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}}$$

A total of 225 questionnaires were distributed. After excluding incomplete responses and accounting for attrition, 200 questionnaires were deemed valid for analysis, corresponding to an effective response rate of 88.8%.

2-4. Instrumentation and Validity

Data were collected using a researcher-developed questionnaire designed to assess scientific interest, attitudes toward science, and perceptions of innovation. Item generation was informed by a comprehensive review of the literature on science communication and motivational frameworks. To enhance contextual relevance, semi-structured interviews were conducted with potential participants and event organizers during the pilot phase.

The instrument consisted of two sections: (1) demographic information (age, gender, education level, and field of study) and (2) scales assessing event evaluation, attitudes toward science, and intentions for future engagement. Items in the second section were rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Validity was assessed through both face and content validation procedures. Face validity was evaluated using a pilot sample (n = 15) to ensure clarity and comprehensibility. Content validity was established by an expert panel of eight specialists in science communication, health education, and survey methodology. The Content Validity Ratio (CVR) and Content Validity Index (CVI) were calculated, and items not meeting acceptable thresholds were revised or removed (16).

Internal consistency reliability was evaluated using Cronbach's alpha coefficient, with values above 0.70 considered acceptable (17).

2-5. Data Analysis

Data were entered, cleaned, and analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize participant characteristics and study variables. Normality of composite scores was assessed using the Kolmogorov–Smirnov test and visual inspection of distributions. Independent-samples t-tests were used for two-group comparisons, and one-way ANOVA with appropriate post-hoc tests and p-value adjustment was used for comparisons across more than two groups. A p-value of less than 0.05 was considered statistically significant.

2-6. Ethical Considerations

The study protocol was approved by the Institutional Review Board and Ethics Committee of Kerman University of Medical Sciences (Ethics Code: IR.KMU.REC.1405.107). The study adhered to the ethical principles outlined in the Declaration of Helsinki (18).

All participants received information about the study objectives, procedures, and voluntary nature of participation prior to data collection. Written informed consent was obtained from all respondents, who were also informed of their right to withdraw at any time without penalty (19). To ensure confidentiality, all data were de-identified at the point of entry and analyzed in aggregate form (20).

3- RESULTS

A total of 200 participants completed the questionnaire and were included in the final analysis.

3-1. Descriptive Statistics

3-1-1. Participant Characteristics

As presented in **Table 1**, the sample was predominantly female (57.0%). University students (40.5%) and members of the general public (40.0%) each comprised approximately two-fifths of the sample, while school students accounted for 19.5%. In terms of educational attainment, just over half of the participants held a diploma (51.5%). Participants' ages ranged from 10 to 52 years, with a mean age of 27.90±12.97 years.

Table-1: Demographic Characteristics of the Participants (n = 200).

Variables	Category / Statistic	Value
Age (years)	Range	10–52
	Mean ± SD	27.90±12.97
Gender	Female	114 (57.0%)
	Male	86 (43.0%)
Participant role	School student	39 (19.5%)
	University student	81 (40.5%)
	General public	80 (40.0%)
Educational level	Below diploma	28 (14.0%)
	Diploma	103 (51.5%)
	Bachelor's degree	35 (17.5%)
	Master's degree or higher	34 (17.0%)

Note. SD = Standard deviation.

3-1-2. Item-Level Descriptive Findings

Overall, participants reported favorable perceptions of the Science Night event. As shown in **Table 2**, mean scores for the 14 questionnaire items ranged from 3.68±1.02 to 4.21±1.04 on a 5-point Likert scale.

The highest-rated item was participants' willingness to recommend the event to others (4.21±1.04), followed by the clarity of the presenters' explanations (4.13±0.86). In contrast, the lowest mean scores were observed for confidence in understanding scientific concepts after the event (3.68±1.02) and confidence in participating in scientific discussions (3.71±1.15).

Table-2: Item-Level Descriptive Statistics for the Science Night Questionnaire (n = 200).

Item	Mean ± SD
1. The scientific content presented at the event was engaging and informative.	4.11 ± 0.94
2. The hands-on activities and experiments were enjoyable and useful.	4.07 ± 0.84
3. The presenters' explanations were clear and understandable.	4.13 ± 0.86
4. The planning and organization of the event were appropriate and well-managed.	3.81 ± 1.02
5. I would like to participate in similar scientific events in the future.	4.09 ± 1.06
6. Participating in this event changed my view of the importance of science.	3.84 ± 1.08
7. I now feel that science is an interesting and accessible subject.	3.95 ± 1.04
8. This event increased my interest in following scientific news and topics.	3.80 ± 1.01
9. After attending this event, I feel capable of understanding scientific concepts.	3.68 ± 1.02
10. I now have more confidence to participate in scientific discussions.	3.71 ± 1.15
11. This event motivated me to try harder in science-related studies.	4.01 ± 0.99
12. I intend to study more about the scientific topics presented in the future.	3.89 ± 1.06
13. This event encouraged me to consider further study in scientific fields.	3.82 ± 1.11
14. I would recommend this event to my friends.	4.21 ± 1.04

Note. Items were rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). SD = Standard deviation.

3-1-3. Descriptive Statistics of the Main Study Variables

Descriptive statistics for the four core constructs are presented in **Table 3**. Event Evaluation had the highest mean score (4.04±0.71), followed by Behavioral Intention (3.91±0.93) and Attitude toward Science (3.86±0.90). Scientific Self-Efficacy had the lowest mean score (3.80±0.89).

Table-3: Descriptive Statistics for the Main Study Variables (n = 200).

Variables	Mean	SD
Event evaluation	4.04	0.71
Behavioral intention	3.91	0.93
Attitude toward science	3.86	0.90
Scientific self-efficacy	3.80	0.89

Note. SD = Standard deviation. Higher scores indicate more favorable evaluations or stronger construct levels.

3-2. Inferential Statistics (Group Comparisons)

Independent-samples t-tests and one-way ANOVA were conducted to examine differences in study variables across demographic groups (**Table 4**).

3-2-1. Comparison by Gender

Independent-samples t-tests revealed no statistically significant differences between female and male participants in Event Evaluation (p=0.197), Attitude toward Science (p=0.646), Scientific Self-Efficacy (p=0.381), or Behavioral Intention (p=0.592).

Although female participants reported slightly higher mean scores in Event Evaluation, Attitude toward Science, and Scientific Self-Efficacy, and male participants reported a marginally higher mean score in Behavioral Intention, these differences were not statistically significant.

Table-4: Comparison of Study Variables by Demographic Characteristics (n = 200).

Variable / Group	n	Event Evaluation (Mean ± SD)	Attitude toward Science (Mean ± SD)	Scientific Self-Efficacy (Mean ± SD)	Behavioral Intention (Mean ± SD)
Gender					
Female	114	4.10 ± 0.58	3.89 ± 0.92	3.85 ± 0.86	3.88 ± 0.85
Male	86	3.97 ± 0.85	3.83 ± 0.88	3.74 ± 0.92	3.95 ± 0.96
t (df = 198)		1.28	0.47	0.87	−0.55
P-value		0.197	0.646	0.381	0.592
Participant role					
School students	39	3.99 ± 0.59	3.62 ± 0.92	3.71 ± 0.77	3.81 ± 0.83
University students	81	3.91 ± 0.87	3.65 ± 0.95	3.65 ± 1.03	3.79 ± 1.09
General public	80	4.20 ± 0.53	4.20 ± 0.73	3.99 ± 0.76	4.08 ± 0.66

Variable / Group	n	Event Evaluation (Mean ± SD)	Attitude toward Science (Mean ± SD)	Scientific Self-Efficacy (Mean ± SD)	Behavioral Intention (Mean ± SD)
F (df)		3.61 (2, 197)	10.13 (2, 197)	3.23 (2, 197)	2.45 (2, 197)
P-value		0.037	<0.001	0.042	0.092
Educational level					
Below diploma	28	3.88 ± 0.60	3.42 ± 0.96	3.60 ± 0.74	3.81 ± 0.83
Diploma	103	3.96 ± 0.80	3.81 ± 0.89	3.82 ± 0.91	3.85 ± 1.01
Bachelor’s degree	35	4.22 ± 0.57	4.21 ± 0.68	3.71 ± 0.83	3.84 ± 0.69
Master’s degree or higher	34	4.25 ± 0.53	4.04 ± 0.95	4.00 ± 0.98	4.22 ± 0.70
F (df)		2.75 (3, 196)	4.78 (3, 196)	1.19 (3, 196)	1.72 (3, 196)
P-value		0.047	0.003	0.311	0.175

Note. Values are presented as mean ± Standard deviation (SD). Independent-samples t-tests were used for gender comparisons, and one-way ANOVA was used for participant role and educational level comparisons. Effect sizes (Cohen’s d for t-tests and η2 for ANOVA) are reported in the supplementary materials.

3-2-2. Comparison by Participant Role

One-way ANOVA indicated significant differences across participant roles for Event Evaluation (F(2,197)=3.61, p=0.037), Attitude toward Science (F(2,197)=10.13, p<0.001), and Scientific Self-Efficacy (F(2,197)=3.23F(2,197) = 3.23, p=0.042). No significant difference was observed for Behavioral Intention (F(2,197)=2.45, p=0.092).

Tukey’s HSD post hoc tests (**Table 5**) showed that:

- The general public reported significantly higher Event Evaluation scores than university students (p=0.025).
- For Attitude toward Science, the general public scored significantly higher than both school students (p=0.002) and university students (p<0.001).
- For Scientific Self-Efficacy, the general public scored higher than university students (p=0.040).

No significant differences were observed between school students and university students across any of the constructs.

3-2-3. Comparison by Educational Level

One-way ANOVA revealed significant differences across educational levels for Event Evaluation (F(3,196)=2.75, p=0.047) and Attitude toward Science (F(3,196)=4.78, p=0.003). No significant differences were found for Scientific Self-Efficacy (F(3,196)=1.19, p=0.311) or Behavioral Intention (F(3,196)=1.72, p=0.175).

Tukey’s HSD post hoc tests (**Table 5**) indicated that:

- Participants with a master’s degree or higher reported significantly higher Event Evaluation scores than those with below-diploma education (p=0.036).

- Participants with a bachelor's degree demonstrated a significantly more positive Attitude toward Science compared with those with below-diploma education (p=0.002).

Table-5: Tukey's HSD Post Hoc Comparisons for Significant ANOVA Results.

Variables	Comparison	Mean difference	P-value (adjusted)	95% CI	Significant
Participant role					
Event evaluation	General public vs. University students	0.29	0.025	(0.03, 0.55)	Yes
Attitude toward science	General public vs. School students	0.58	0.002	(0.18, 0.98)	Yes
Attitude toward science	General public vs. University students	0.55	<0.001	(0.23, 0.87)	Yes
Scientific self-efficacy	General public vs. University students	0.34	0.040	(0.01, 0.67)	Yes
Educational level					
Event evaluation	Master's degree or higher vs. Below diploma	0.37	0.036	(0.02, 0.72)	Yes
Attitude toward science	Bachelor's degree vs. Below diploma	0.79	0.002	(0.25, 1.33)	Yes

Note. Only statistically significant pairwise comparisons are presented. P-values are adjusted using Tukey's HSD. CI = Confidence interval.

4- DISCUSSION

The present study examined participants' evaluations of a Science Night event, along with their attitudes toward science, scientific self-efficacy, and behavioral intentions for future engagement with science. Overall, participants reported favorable evaluations and positive scores across the main study variables. Event Evaluation had the highest mean score, followed by Behavioral Intention and Attitude toward Science, whereas Scientific Self-Efficacy had the lowest mean score, although it remained in a positive range.

These findings are consistent with research on informal science learning, which highlights the value of outreach events in providing accessible, engaging, and socially meaningful encounters with science (1, 6, 7, 21). Informal science environments can complement formal education by promoting experiential learning, public interaction, and personal relevance (1, 6). In this study, high ratings for presenter clarity, engaging scientific content, and willingness to recommend the event suggest that the Science Night program was well received and functioned effectively as a science engagement activity.

The findings on attitudes toward science are also notable. Participants reported generally favorable attitudes, and some of the highest item-level scores reflected willingness to recommend the event and interest in future participation. This pattern is broadly consistent with previous studies showing that positive experiences in informal science settings may reinforce interest in science and support more favorable perceptions of science as accessible and relevant (3, 4, 12). However, because this study did not use a pre-event/post-event design, these findings should be interpreted as positive post-event perceptions rather than evidence of attitudinal change caused by the event.

A similar interpretation applies to scientific self-efficacy. Participants reported moderately positive confidence in understanding scientific concepts and participating in scientific discussions, although this construct had the lowest mean score among the four main variables. This suggests that while a single outreach event may generate immediate interest and favorable impressions, strengthening confidence in one’s scientific abilities may require repeated and more sustained engagement. From the perspective of social cognitive theory, self-efficacy develops gradually through continued exposure, active participation, and opportunities for mastery rather than through a brief event alone (22). Accordingly, Science Night events may serve as useful entry points for public engagement, while longer-term educational interventions may be needed to produce stronger and more durable gains in perceived scientific competence.

Behavioral Intention was also relatively high, suggesting that participants were generally open to future involvement in science-related learning or activities. This is important because a central goal of public science engagement is not only to inform audiences at a single point in time but also to encourage continued curiosity and participation (2, 12). The willingness to recommend the event, together with positive responses to future-oriented items, supports the view that well-designed outreach events can help sustain public interest in science beyond the immediate context.

The subgroup analyses provide additional insight into how different audiences experienced the event. No statistically significant gender differences were observed across Event Evaluation, Attitude toward Science, Scientific Self-Efficacy, or Behavioral Intention, suggesting that the event was similarly engaging for female and male participants. Given ongoing concerns about gender equity and inclusivity in science communication, this is an encouraging finding and supports efforts to design outreach activities that appeal broadly across genders (8, 10).

In contrast, significant differences were observed across participant role for Event Evaluation, Attitude toward Science, and Scientific Self-Efficacy. The general public tended to report more favorable scores than school and university students. Because post hoc tests were not conducted, these differences should be interpreted cautiously. Nevertheless, the pattern may indicate that the Science Night format was particularly well aligned with the expectations and interests of adult public audiences. It is also possible that school and university students evaluated the event through a more critical lens because of their greater familiarity with structured educational settings.

Educational level was also associated with significant differences in Event Evaluation and Attitude toward Science, but not in Scientific Self-Efficacy or Behavioral Intention. Participants with bachelor’s or postgraduate education generally reported more favorable scores than those with lower educational levels, especially the below-diploma group. This may reflect differences in prior exposure to scientific content, confidence in engaging with public science material, or the accessibility of the event format for participants with diverse educational backgrounds. At the same time, the absence of significant educational differences in Behavioral Intention suggests that interest in future science engagement was relatively broad across groups, even when evaluations and attitudes differed.

Taken together, these findings support the broader view that informal science events can serve as valuable platforms for public engagement with science (1, 2, 10, 12). At the same time, audience responses were not fully uniform across demographic subgroups. This has practical implications for future outreach initiatives. Organizers should preserve the interactive and accessible features that were positively received while also considering strategies to better support younger participants and those with lower educational backgrounds, particularly by strengthening confidence in understanding and discussing scientific concepts.

4-1. Limitations

This study has several limitations. First, the cross-sectional post-event design does not allow causal inferences about whether participation in Science Night directly improved attitudes, self-efficacy, or behavioral intentions. Second, the data were self-reported and may be affected by response bias or social desirability. Third, because the study was conducted in the context of a single Science Night event, the findings may not generalize to other outreach formats or populations. Fourth, although significant differences were observed across participant role and educational level, no post hoc analyses were conducted; therefore, subgroup differences should be interpreted cautiously. Future studies should use pre-post or longitudinal designs, include qualitative methods, and compare multiple science outreach events.

5- CONCLUSION

Overall, this study suggests that Science Night was positively received by participants and may represent a valuable informal science engagement initiative. Participants reported favorable event evaluations, generally positive attitudes toward science, moderately positive scientific self-efficacy, and positive intentions for future engagement. While no significant gender differences were found, participant role and educational level were associated with selected outcomes, particularly Event Evaluation and Attitude toward Science; however, these differences should be interpreted cautiously in the absence of post hoc testing. Future studies employing pre-post or longitudinal designs are needed to assess whether participation in such events leads to sustained improvements in attitudes, perceived scientific competence, and continued engagement with science.

6- AUTHORS' CONTRIBUTIONS

Study conception or design: HB, MS; Data analyzing and draft manuscript preparation: MM, FT, FM, ZB, AR, SH, and MG; Critical revision of the paper: MS; Supervision of the research: MS and HB; Final approval of the version to be published: HB, MM, FT, FM, ZB, AR, SH, MG, and MS.

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8- CONFLICT OF INTEREST: None.

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