

Science Popularization Strategies for Hand Hygiene and Health in Society

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Abstract: Strengthening the scientific popularization of hand hygiene and health is the key to raising public health awareness, preventing the spread of disease and building barriers to public health safety. In view of the current international public health crisis situation, this paper discusses how to effectively enhance public awareness and behaviour of hand hygiene and designs a strategy for science popularization. Based on a review of existing research results, this paper explores how to carry out science popularization and publicity work in response to the specific requirements of hand hygiene and health. The study used a combination of several technical means to obtain data, including online questionnaires, in-depth interviews and big data analysis. The study found that the average rate of correct handwashing increased from 33.96% before implementation to 67.04%, and the duration of handwashing increased from 9.648 seconds to 23.012 seconds. These data significantly indicate a better improvement in hand hygiene knowledge, attitudes and behaviour of community residents. Meanwhile, this paper combines Augmented Reality (AR) and Virtual Reality (VR) with intelligent monitoring devices to design a personalized referral algorithm for the public, which enhances the public's participation and attention to the public.

1. Introduction

With the acceleration of global integration, hand hygiene and health has become a widespread attention to infectious disease prevention and control measures in countries around the world today. Currently, the knowledge and practical level of public hand hygiene has been significantly improved, but in the current situation, in the face of emergencies, as well as changes in the public's protective consciousness, there is still a need to further strengthen the knowledge and action of public hand hygiene. Hand hygiene and health promotion is a major means of improving the health quality of all people and is an important means of promoting hand health awareness and behaviour among all people. Although existing studies have provided a more comprehensive perspective and means for science communication research, research on science communication strategies for specific populations is still weak. Especially in today's world health crisis, how to better promote public awareness and action on hand health has become an urgent issue.

This paper explores more efficient prevention and control measures for the specific requirements

of hand hygiene and health. The innovation of this paper is reflected in the cross-fertilization of multiple disciplines, especially the introduction of advanced scientific and technological means, such as AR and VR, into popular science propaganda, and the combination of big data for recommendation. This approach not only increases the interactivity of popular science propaganda, but also increases the effect and relevance of communication. It is hoped that the research in this paper can open up a new way of thinking for the development and application of science publicity research and put forward new ideas for public health management work.

2. Related Works

In recent years, science popularization has been one of the most valued new modes of communication in recent years. Researchers such as Danilina Y V conducted an empirical study on the impact of science and technology publicity on creative communication, both theoretically and empirically [1]. Ghadimi A and Hejazi E conducted an in-depth study on science popularization models in Iran, using a grounded theory research method [2]. Alvim da Silva A E F et al. conducted empirical research on technology communication based on the theory of communication behavior[3]. Jiang F and Qiu X studied how to popularize subject knowledge to the public through a 3MT speech format [4]. Kong Y and Zhang J constructed a data intelligence based mangrove marine science popularization education platform and explored its application [5]. Sterk F M et al. assessed the popularization discourse of first year students through a case study [6]. Du J et al. examined how governments can defuse environmental radicalism through scientific greening strategies [7]. Pazoto C et al. reviewed the history of education and popularization research on marine environmental issues in Brazil [8]. Smith S R et al. and Liang W et al. explored interventions to improve hand hygiene behaviour during the COVID-19 pandemic from the theoretical and practical levels, respectively [9-10]. These studies mainly used quantitative and qualitative research tools such as case studies, theoretical analyses, questionnaire surveys, and meta-analyses, with the aim of exploring a proven pathway and countermeasure for STC.

However, there is still a lack of research on specific issues such as hand hygiene and health. To address these issues, this paper will, on the basis of a comprehensive review of existing research results, identify the shortcomings of current science popularization efforts and explore more efficient science popularization strategies based on the specific needs of hand hygiene and health. These strategies not only focus on the transmission of knowledge, but also pay more attention to the internalization of knowledge and long-term behavioural change, with a view to promoting the continuous improvement of hand hygiene and health among the population, and contributing to public health and safety.

3. Methods

3.1 Development of Science Popularization Strategy

Based on health promotion theory, social cognitive theory and communication theory, this paper constructs a hand hygiene health science communication strategy based on social participation through innovative communication methods and contents [11-12]. It is based mainly on behavioural changes of individuals, their awareness of hygiene activities, and the effectiveness of the transmission of hygiene knowledge. The innovations of the strategy include augmented reality and virtual reality technologies, smart hand hygiene monitoring systems, big data analysis, personalized promotional content, social media interaction strategies and integrated cross-platform communication. Figure 1 shows the relevant elements of the science communication strategy designed in this paper:

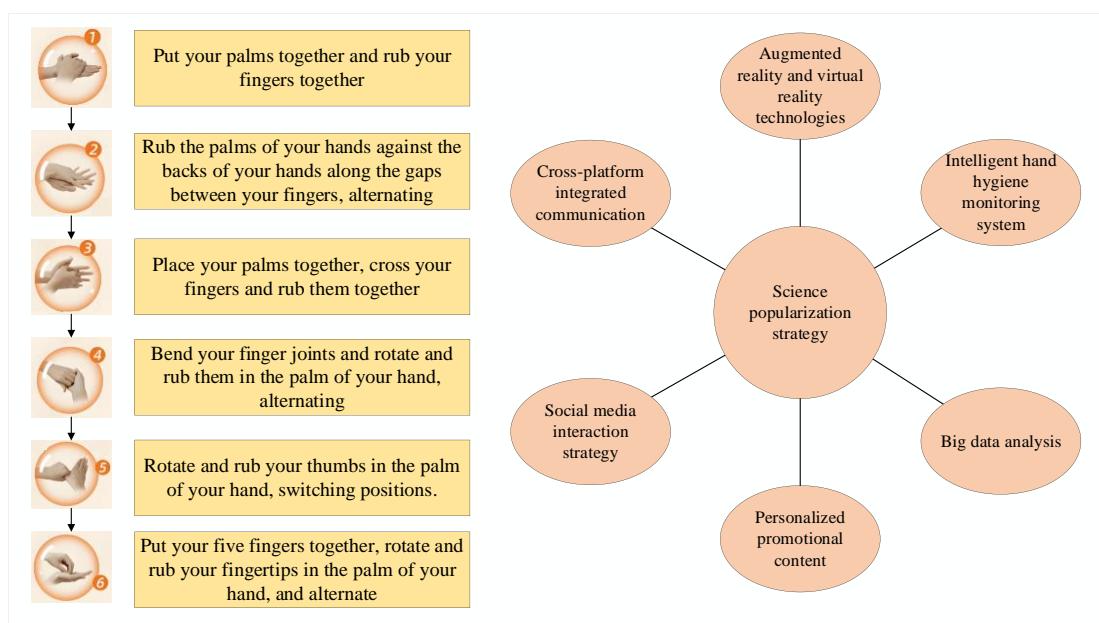


Figure 1: Science popularization promotion strategy

In this paper, a series of AR and VR applications will be developed to help users perform hand hygiene in virtual reality by simulating realistic hand washing scenarios. Combined with the latest wearable technology, a smart bracelet or ring that monitors the number of times and length of time a user washes his/her hands will be developed using wearable advanced technology [13-14]. The monitoring system employs sensor technology to detect moisture and detergent residue on hands to ensure that users follow the recommended cleaning methods. In addition, the device will also remind users to clean their hands at important moments, such as before meals and after using utilities, by means of vibration or visualization. In order to optimize the communication strategy in real time, the timely optimization of communication decisions is achieved through big data collection and analysis of user feedback, behavioural patterns and advocacy results. Through a comprehensive study of interactive behaviour in social media, questionnaire survey results and information collected by intelligent monitoring devices, those messages with the best communication effects are identified and further guided. Based on the results of big data analysis, personalized hand health education content is developed for different groups of people, and the algorithm takes into account the user's age, gender, occupation, habits and preferences to ensure that the promotional messages are relevant and appealing [15-16]. Highly interactive promotional campaigns such as online handwashing competitions, quizzes and virtual handwashing competitions are conducted using social media. The programme aims to promote the exchange of healthy hand habits among users, while also providing educational sessions on appropriate hand washing practices. At the same time, synergistic dissemination of relevant popular science content is achieved through multiple online platforms and traditional media to maximize the dissemination effect. These include advertisements on television, radio, newspapers, online advertisements, mobile phone applications, as well as electronic displays used in public places.

3.2 Implementation Process of Promotion Strategy

In this paper, we will adopt a novel promotional strategy by filming a set of short films with dramas, developing online and mobile games, and using role-playing and drama demonstrations to teach users how to develop hand-washing habits and give timely feedback. In addition, through social media platforms, activities such as "Q&A" and "theme annotation" are carried out to guide

netizen to participate in the exchange and experience of "hand health", enhancing the interaction and dissemination ability of epidemic prevention work. Through in-depth analysis of the needs and preferences of the target audience, personalized promotional materials such as posters, leaflets and animated short films are developed and promoted in different ways such as schools, medical institutions, offices, bus stops and community squares. We need to collaborate with government, educational institutions, enterprises, and civil society organizations to promote the popularization of hand hygiene knowledge. At the community level, this research plan aims to train educators, healthcare workers, and community members through hand health lectures and public information, so that they can better understand information related to hand health. By developing auxiliary tools such as AR and VR, we assist users in hand washing operations in virtual reality, and monitor the frequency of hand washing in a timely manner through smart bracelets, smart rings, and other devices. Technical support and innovation will run through the entire promotional strategy. This paper will develop AR and VR applications to enable users to learn and practice correct hand hygiene steps in a virtual environment, while designing smart bracelets or smart rings to monitor the frequency and duration of user hand cleaning.

3.3 Data Collection

In order to comprehensively assess the effectiveness of the science promotion strategy, this paper will use online questionnaires to investigate the basic situation, hand hygiene knowledge level, attitudes and behaviour of different groups of people, and use intelligent monitoring devices to track and follow up the hand hygiene behaviour of different groups of people. Through in-depth interviews and thematic sub-group talks, we will gain a deeper understanding of the public's acceptance and preference of science popularization work, and put forward corresponding comments and opinions. Social media analyses will monitor public interaction and feedback on science popularization information, and evaluate the dissemination effect of various types of information on various platforms and audience participation. At the same time, the interaction and learning behaviour were investigated by collecting data on the use of AR/VR software, and the level of adoption of health knowledge was studied.

This paper will evaluate the implementation effect of the science popularization strategy from the three levels of public cognition-attitude-behavior transformation. It has certain practical significance in terms of cost-benefit analysis, sustainability assessment, and scalability assessment. The strategy will be evaluated from four aspects: implementation cost, audience coverage, long-term effect, and user satisfaction. In addition, this paper will explore the long-term sustainability of the science popularization strategy, including its impact on the environment, resource requirements, and promotion of social values. Popularity considerations will assess the applicability and acceptability of the strategy in different cultural, economic and social contexts, ensuring that the communication content is accessible and effective for all target audiences.

4. Results and Discussion

4.1 Quantitative Assessment of Changes in Knowledge, Attitudes and Behaviour

This paper emphasizes the importance of raising people's awareness of hand hygiene, and at the same time analyses in depth the changes in people's 'awareness' and 'behaviour' that it has brought about. A set of quantitative data was used to assess the effectiveness of the popularization of science. This paper evaluates the functionality of the science education strategy by comparing it with pre-implementation data, and Figure 2 shows the results of the quantitative assessment of knowledge and attitudes obtained through data collection:

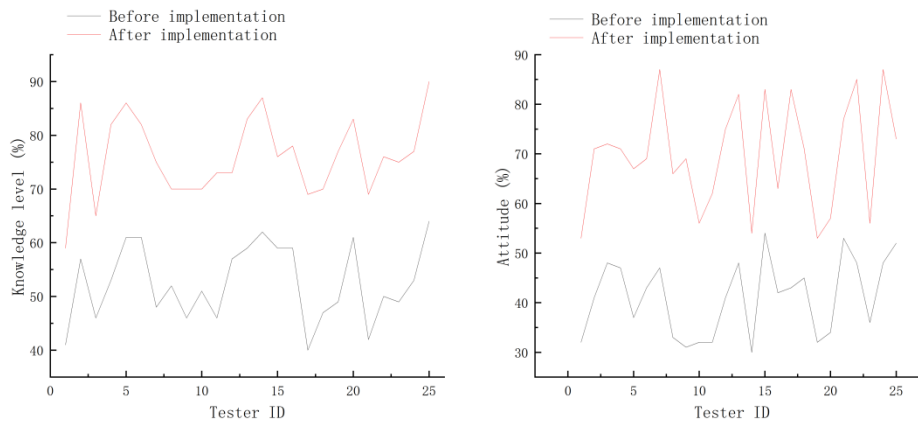


Figure 2: Results of quantitative assessment of changes in knowledge, attitudes

Before the implementation of the science popularization strategy, the mean value of the knowledge level was 52.52%, and after the implementation of the strategy, the mean value of the knowledge level increased significantly to 76.04%, which shows that the publicity strategy has a certain effect on enhancing the awareness of the public. The minimum level of knowledge increased from 40% to 59% and the maximum from 64% to 90%; not only did the average level increase, but the knowledge scores of all respondents increased, and there was a wider spread of knowledge. The minimum values of attitudes increased from 30% to 53% and the maximum values increased from 54% to 87%, showing an overall positive shift in audience attitudes and a positive response to the campaign messages. Figure 3 shows the quantitative behavioural assessment data, which includes the rate of correct handwashing, frequency of handwashing and duration of handwashing:

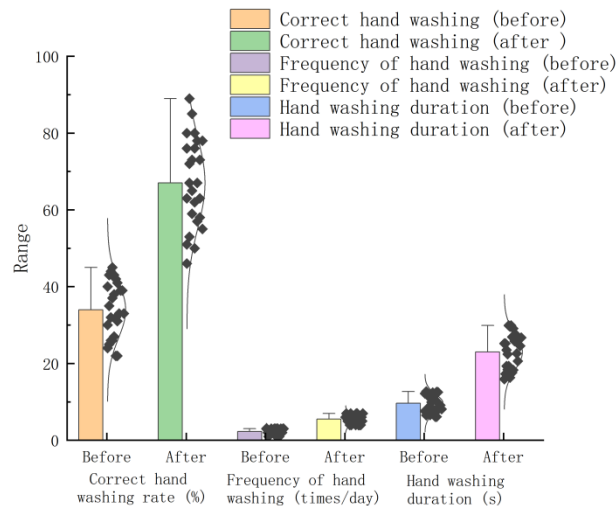


Figure 3: Quantitative behavioural assessment results

The minimum value for correct hand washing increased from 22% to 46% and the maximum value from 45% to 89%, showing that the majority of respondents were washing their hands much more correctly than before. Handwashing frequency overall is also higher after the implementation of the strategy, and the increase in handwashing duration, from an average of 9.648 seconds to 23.012 seconds, can be reflected in the fact that the public pays more attention to the cleansing effect of handwashing, and people will be more careful when washing their hands, which in turn improves the cleansing effect of handwashing. The popularization strategy has led to a significant increase in people's health awareness and lifestyles, which has not only led to an effective

improvement in hand-washing habits, but also to an increase in the frequency and duration of hand-washing and prevention of the spread of diseases.

4.2 Cost-benefit Analysis

In order to gain an in-depth understanding of the economic impact of different science promotion methods, this paper provides a comprehensive analysis of the cost-effectiveness of various promotion methods. By comprehensively comparing the costs of science promotion strategies, community activities and printed materials, their characteristics in terms of configuration and funding utilization were determined. Table 1 presents the data from the cost-benefit analysis:

Table 1: Cost benefit analysis

Cost Type	Science popularization strategy	Community activity	Printing material
Material cost (yuan)	12032	7361	11766
Technology cost (yuan)	29966	10562	0
Human resource cost (yuan)	33513	45284	15574
Advertising and promotion expenses (yuan)	47179	59563	17173
Venue and equipment rental (yuan)	19944	22283	0
Transportation and distribution (yuan)	5369	13671	5682
Management fee (yuan)	8658	14397	4109
Training cost (yuan)	7460	8764	1817
Total cost (yuan)	164121	181885	56121

The relatively high material cost of 12,032 yuan for the science outreach strategy, compared with 7,361 yuan for community events and 11,766 yuan for printed materials, may be attributed to the fact that the science outreach strategy uses more innovative materials and technologies. The science outreach strategy was significantly more expensive than the other two methods in terms of technology costs, but the science outreach strategy was slightly less expensive than the community events in terms of human resources, advertising and promotion costs. In terms of total cost data, the total cost of the science promotion strategy was 164,121 yuan, community activities had the highest total cost of 181,885 yuan, while the total cost of printed materials was relatively low at 56,121 yuan. Printed materials are a traditional process which has the advantage of being inexpensive to manufacture. In contrast, although the science outreach strategy has a higher investment in technology costs and human resource costs, its overall cost is still lower than that of community activities.

4.3 Sustainability and Generalisability Considerations

This paper assesses sustainability and pervasiveness and evaluates their impacts over the long term and in the long term. Sustainability focuses on the long-term environmental, economic, and social impacts, while pervasiveness refers to the ability of the strategy to be realized and adapted to various audiences. In order to quantify these abstract concepts, a series of assessment indicators

were set up and scored separately (out of a total of 100 points) for science outreach strategies, community activities and printed materials. The sustainability and popularity scoring data obtained are shown in Table 2:

Table 2: Sustainability and popularity

Core value	Evaluation metrics	Science popularization strategy	Community activity	Printing material
Sustainability	Long-term impact (score)	88.6	61.9	54.2
	Economic benefits (score)	88.7	58.3	48.7
Popularity	Audience breadth (score)	94.7	77.9	66.4
	Educational adaptability (score)	90.5	78.6	53.7
	Cultural sensitivity (score)	91.7	69.5	52.6

The science popularization and publicity strategy scored a high score of 88.6 in terms of long-term impact, taking into account the long-term positive effects on the environment and society in its design. In contrast, community activities and printed materials scored lower at 61.9 and 54.2, respectively, reflecting the limitations of traditional methods in terms of long-term impact. Science promotion strategies have good economic benefits, and in terms of popularity, science promotion strategies scored the highest in terms of audience breadth with a score of 94.7, with content and methods that are able to attract and adapt to audiences from different backgrounds. While community activities and printed materials methods scored lower, science popularization strategies are both highly educationally applicable and culturally sensitive, and can well meet the needs of different groups of people and produce good social and economic effects.

5. Conclusion

In this paper, a multidisciplinary research method was used to explore and develop a set of popular science propaganda strategies for social hand hygiene. This paper investigated the residents' knowledge of hand hygiene and their attitudes towards hand hygiene. The results show that compared with community activities and traditional printed materials, the popular science propaganda strategy in this paper has more advantages in knowledge popularization, attitude change and behavior promotion, and this strategy has greater promotion value. However, existing research still faces many shortcomings, such as the lack of monitoring of long-term effects on residents and the lack of cross-cultural adaptability assessment. Through continuous improvement and change, the "propaganda" strategy with popular science propaganda as the core will surely enable the public health cause to develop rapidly.

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