

Evaluating The Potential Of A Digital Oral Health Intervention To Enhance Knowledge, Attitudes, And Practices Related To Oral Health Among Urban Population- A Cross Sectional Study

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Abstract

Introduction: maintaining good oral health and avoiding avoidable dental diseases require optimal oral health behaviors. The purpose of this study was to assess how well a digital oral health intervention changed oral health-related knowledge, attitudes, and behaviors.

Materials and method: two research involving 200 healthy people were carried out. Before and after the know your oqtm intervention was finished, demographic information and oral health-related knowledge, attitudes, and practices (kaps) were gathered. There were 19 multiple-choice questions on the kaps questionnaire. Feedback and comprehension were also gathered.

Result: the two investigations were completed by 100 (50%) female participants and 100 (50%) male individuals. Five out of seven knowledge questions and two out of five attitude questions in both studies shown significant changes before and after the intervention, with participants' attitudes and knowledge regarding oral health improving. Four of the seven practice questions in the second study showed substantial changes before and after the intervention, whereas only one practice altered in the first study. In all cases, the intervention received generally positive response and was highly comprehensible.

Conclusion: a digital oral health intervention was successful in increasing knowledge, changing attitudes and self-reported practices with regards to oral health in a diverse sample of the urban population.

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I. Introduction

One of the most prevalent yet mostly avoidable illnesses in the world is oral disease. According to the Global Burden of Illness Study, dental caries of permanent teeth is the most common oral illness, affecting an estimated 3.5 billion people worldwide in 2019, with an estimated 2 billion cases. Dental caries affects 520 million children and adults. The prevention of oral diseases, particularly dental caries and periodontal disease, can be achieved primarily through regular, excellent oral hygiene practices. The American Dental Association (ADA), recommends (a) using fluoride toothpaste twice a day to clean teeth for two minutes, (b) everyday oral hygiene, such as flossing, (c) maintaining a nutritious diet that excludes sugar-filled drinks and snacks, and (d) Having frequent dental checkups. Although the ADA's suggestions seem like common sense, they include several behaviours that people should: (1) be aware of, (2) understand where, when, and how to carry out these actions, and (3) be inspired to carry out these actions consistently throughout your life. It's not Surprisingly, given the significance of maintaining good oral hygiene behaviour, a lot of people—adults and kids alike—find it difficult to adopt and maintain these behaviours. According to estimates, approximately 50% of adults in Chennai do not brush their teeth as suggested. Times day in frequency [3]. In Chennai, however, 25% of all adults do not brush as frequently as is advised. The ability to do and maintain a specific behaviour, such as flossing or brushing one's teeth, depends heavily on knowledge. The COM-B model of behaviour modification comprises three interwoven components: capability, opportunity, and motivation [5]. The presence of these three elements is necessary for certain behaviours (like flossing or brushing teeth) to be implemented, one's physical aptitude (such as dexterity and abilities) and psychological capability—of which knowledge is an essential component—are further subcategories of capability. Ability, whether material or psychological factors by themselves is insufficient to cause a behaviour, but one must be aware of where, when, and how to Perform it well. Different behavioural modification strategies, such as training on how to conduct the target behaviour(s) and information regarding health repercussions, can be used to increase knowledge and, in turn, affect psychological capability [7]. A person's oral health can affect many aspects of their life, including their general quality of life, social interactions, and physical and mental health. Mental and systemic health are related to oral health. Increasing public knowledge of the value of maintaining good oral health is essential to preventing the onset and spread of dental illnesses and all of their detrimental short- and long-term effects on quality of life [9]. Even though maintaining good dental health is important, certain members of the general public lack basic education, information, and understanding in this area. For instance, research in Chennai revealed that less than 50% of people brush twice daily. They did not attend the dentist as often as was advised [10, 11]. Dental illness is negatively impacted by ignorance and insufficient information about proper oral hygiene practices [12, 13]. A digital oral health intervention called Know Your OQTM aims to raise general public awareness of oral health issues by educating and informing them. It employs a dual strategy.

A website that educates users on oral health, oral health behaviours, the connection between oral and systemic health, the significance of preserving good oral health throughout life, and important oral health tips, such as seeing a dentist frequently.

B. An oral quotient (OQ) score, a knowledge exam, and a brief, interactive oral health quiz with comments on each question are included at the end.

The basis for this resource's consideration as a component of a larger behavioural intervention is laid by the techniques it employs, which include teaching target behaviour execution and providing information about the health effects of raising awareness and altering attitudes about oral health. As smartphone usage, internet access, and digital literacy continue to rise in both developed and developing countries, digital-enabled interventions are gaining traction.

The average internet penetration rate worldwide is likewise at a record high, at 65% [16]. People that use digital information and education campaigns can be provided with access to a rich learning environment. This enables students to be adaptable and flexible while also improving their communication skills.

Aim

The purpose of this study is to assess how well an oral health digital literacy intervention (Know Your OQTM, KYOQTM) affects oral health-related knowledge, attitudes, and behaviours. The aims listed below helped to support this goal:

1. Determine whether it is feasible to carry out research with a digital oral health intervention.
2. Assess modifications in oral health-related knowledge, attitudes, and practices
3. Examine the Know Your OQTM campaign's comprehensibility and gather data on potential modifications.
4. Get input regarding intervention.

II. Materials And Methods

Study design

A stepwise, pre-test/post-test investigation including 200 participants was carried out. A sample of 100 participants participated in the Know Your OQTM initiative's initial evaluation.

To improve the results' generalizability, a second evaluation (N = 100) was carried out with a more varied (demographically and economically) sample.

The study's sample sizes, which ranged from the mid-100s to the high 200s, were consistent with earlier research using an adult Knowledge, Attitudes, and Practices (KAPs) questionnaire [17, 18].

Sample & Size estimation and data collection

Convenience recruitment was used for the first study, where individuals who had previously indicated interest in participating in research studies were contacted and given details about the project. Purposive sampling was used in the second trial when volunteers were chosen from a similar pool of potential participants. Supplied on the internet and (2) to finish the Know Your OQTM test.

After completing these steps, participants received a questionnaire to fill out regarding readability and general comments about the website and the Know Your OQTM survey. Participants responded to the post-test KAPs questionnaire one week later.

Table 1. Sample Characteristics

| | | STUDY-1 N=100 | STUDY-2 N=100 |
|--------------------------------------|---------------------------|------------------|------------------|
| Gender | Male | 50[50%] | 42[42%] |
| | Female | 50[50%] | 58[58%] |
| Education | Postgraduate education | 20[21%] | 0[0%] |
| | Higher education graduate | 37[49%] | 16[18%] |
| | Some college education | 0[0%] | 52[51%] |
| | High school graduate | 43[30%] | 25[28%] |
| | Some high school graduate | 0[0%] | 7[3%] |
| Employment status | Full time employed | 69[70%] | 46[46%] |
| | Part time employed | 10[11%] | 15[15%] |
| | Self employed | 4[8%] | 9[9%] |
| | Stay at home parent | 3[5%] | 6[6%] |
| | In training/education | 3[2%] | 3[3%] |
| | Un-employed | 1[3%] | 8[8%] |
| | Retired | 1[2%] | 13[13%] |
| Experience with oral health problems | Yes | 32[32%] | 54[54%] |
| | No | 64[64%] | 41[41%] |
| | Don't know | 4[4%] | 4[4%] |
| If yes, is it an ongoing issue? | Yes | 39[39%] | 60[60%] |
| | No | 61[61%] | 40[40%] |

Statistical Analysis

The demographic data was summarized using descriptive statistics. To ascertain whether the knowledge and attitude changes between the pretest and post-test were statistically significant, Mc Nemar's tests were employed. T-tests were applied to practice modifications. For feedback and comprehension, descriptive statistics were employed. With Version 2.0 SPSS.IBM USA was used, all statistical analyses were carried out.

III. Results

Sample characteristics

A total sample of 200 participants were enlisted for the two investigations. An overview of the sample and its salient features is provided in Table 1 In order to improve the representativeness of the study population overall, Study 2 purposefully concentrated on a more demographically varied sample There were 200 participants in total from both studies, the majority of whom were female (N = 108), had some college education or more (such as graduate school), were employed full-time (N = 116), and belonged to the white ethnic group (N = 143). In contrast, to study 1, participants in study 2 included greater numbers of distinct demography

Retention and completion rates

There were no dropouts in any of the two experiments, yielding a 100% completion and retention rate.

Knowledge, attitudes, and practices (KAPs)changes

Significant gains were observed in certain knowledge and attitude questions about oral health in Study 1 (N = 100). According to knowledge tooth cavities are the most prevalent illness worldwide. which increased by

30 percentage points (ppt) $t(100) = 25.93, p = 0.000$. Even so, only 48% of participants could identify dental cavities as the most common disease after the test (up from 18% to 48%). Eighty-nine percent of participants had knowledge of oral health affecting general health ($t(100) = 32.60, p = 0.000$). There was also an eighty-nine percent increase in knowledge of oral disease symptoms ($t(100) = 12.90, p = 0.000$), forty-four percent of participants had knowledge of the causes of bad breath ($t(100) = 3.89, p = 0.048$), and ninety-four percent of participants had knowledge of the relationship between oral health and mental health (94% of participants post-test) $t(100) = 20.05, p = 0.000$. No significant changes were seen in the association between oral and general health and the most powerful risk factors for oral cancer. However, participants in both cases and studies demonstrated a very high level of awareness at baseline, for example, regarding the connections between oral and general health; in the study, 96% and study 98 percent of the sample were already aware of these connections. Regarding attitudes, enhancements were seen in 2 questions before and after the intervention, with a 17 percentage point increase in attitudes agreeing that fluoride toothpaste is important for dental health) Post-test results showed a high level of agreement among participants, with a t-value of 15.43 and a p-value of 0.000 (100 participants). 9 percentage point increase in perspectives on the significance of 95% of participants voted for brushing twice a day. The post-test agreement was significantly higher, $t(100) = 5.14, p = 0.023$. Attitudes towards the role of sugar did not undergo any notable changes. importance of regular dental check-ups, dental decay, and their impact of build-up on tooth decay. All those behaviours were already highly evident. Positive with minimal, positive changes before and after the intervention. and a 9 percentage point increase in attitudes towards the significance of 95% of participants agreed or strongly agreed on the importance of brushing twice daily. The post-test agreement was significantly higher ($t(100) = 5.14, p = 0.023$) compared to the pre-test agreement. Attitudes towards the role of sugar did not experience any notable changes. Tooth decay, the significance of regular dental appointments, and the impact of tartar on tooth decay.

Table 2. Knowledge And Attitude Changes

| knowledge | Study1N=100 | | | Study2N=10 | | |
|--|----------------------------|------|------------|---------------------------|------|------------|
| | pre | Post | PPT change | pre | post | PPT change |
| Dental caries most common disease in the world | 18% | 48% | +30A | 24% | 44% | +20A |
| Link between oral health an general health | 96% | 96% | +0 | 98% | 99% | +1 |
| Oral health impact on general health | 56% | 89% | +33A | 55% | 90% | +35A |
| Risk for oral cancer | 72% | 66% | -6 | 66% | 61% | -5 |
| Signs and symptoms for dental disease | 71% | 89% | +18A | 70% | 90% | +20A |
| Cause of bad breath | 32% | 44% | +12A | 34% | 44% | +10A |
| Link between oral health and mental health | 75% | 94% | +19A | 79% | 95% | +16A |
| Attitudes | % agreed or Strongly agree | | | %agreed or Strongly agree | | |
| | pre | post | PPT change | pre | post | PPT change |
| Frequent consumption of sugar causes caries | 96% | 96% | +0 | 91% | 93% | +2 |
| Plaque causes gum disease and dental decay | 96% | 97% | +1 | 96% | 98% | +2 |
| Fluoride strengthens teeth | 75% | 92% | +17A | 66% | 80% | +14A |
| Necessary to brush teeth twice a day | 89% | 95% | +6A | 91% | 96% | +5A |
| Frequent visit to dental professional is necessary | 95% | 98% | +3 | 88% | 92% | +4 |

The attitudes were already highly developed. Positive results showed minor improvements before and after the intervention. In this study 1, the only practice that changed was the use of mouthwash. Self-reported mouthwash usage increased by 7 points per day, $t(100) = 4.08, p = 0.43$, and only 25% of participants continued to use mouthwash after the test. There were no more modifications made to oral health-related practices. In Study 2 (with 100 participants), there were comparable, meaningful shifts in knowledge. pretest-post-test: a 20-percentage point increase in awareness was observed.

Tooth decay is the most prevalent illness worldwide. A t-score of 19.76 was calculated, resulting in a p-value of 0.000. Nevertheless, only 44% of the individuals involved were still. capable of identifying tooth decay as the most common disease after examination. Overall, there was a 35ppt rise in understanding about oral.90% of participants in the post-test reported that their overall health was impacted by their health condition.t score of 48.96 resulted in a significant p-value of 0.000, reflecting a 20% rise in knowledge concerning signs of oral illness (90% of respondents after the test) t-value of 25.52 was obtained with a p-value of 0.000, indicating a significant effect from a 10ppt increase in knowledge about. reasons for halitosis revealed a significant increase in perception among 44% of participants in the post-test, with a t-statistic of 6.57 (df = 100). $p = 0.010$ and a 16-percentage point rise in awareness concerning the relationship 95% of individuals showed a significant connection (t-value of 24.74, p-value of 0.000) between dental health and mental wellbeing at the post-test. As in the first research,

there were no Notable changes were found in the questions about the relationship between oral health and general health, which are interconnected and the primary causes of oral cancer. According to research 1, attitudes regarding the value of fluoride toothpaste improved by 14 percentage points (80% of participants "agreed" or "strongly agreed" after the test). $t(100) = 13.40, p = 0.000$ and a 9ppt improvement in participants' attitudes about the value of brushing twice a day (95% "agreed" or "strongly agreed" after the test). $p = 0.043, t(100) = 4.08$. Similar to the first study, there were no appreciable shifts in participants' beliefs about the contribution of sugar to dental decay, the value of routine dental checkups, and the influence of plaque on dental decay. With only small, positive changes from the pretest to the post-test, all those attitudes were already extremely positive. Consistent with study 1, attitudes regarding the significance of fluoride toothpaste improved by 14 percentage points (80% of participants "agreed" or "strongly agreed" after the test). attitudes about the significance of brushing twice a day improved by 9 points, with 95% of participants saying they "agreed" or "strongly agreed" after the test ($t(100) = 13.40, p = 0.000$). With $p = 0.043, t(100) = 4.08$. Similar to the first study, attitudes toward the contribution of sugar to dental decay, the significance of routine dental checkups, and the influence of plaque on dental decay did not significantly change. With only slight improvements observed between the pretest and post-test, all those attitudes were already extremely positive. Readability and comments in terms of comprehensibility, participants in both studies reported that, respectively, 90% and 92% of them found the website and quiz to be easy to navigate and understand. This level of response suggests that the website and quiz have a logical, user-friendly design, which is an essential component of digital interventions. In terms of overall study participant comments, 58% and 59%, respectively, stated they would like more detailed instructions on how to brush and floss their teeth to complement the material that was already provided. Finally, 46% of participants believed that the combined effect of the website and quiz was higher.

IV. Discussion

Some aspects of oral health knowledge, attitudes, and practices were successfully changed by this digital oral health intervention. Participants' positive perceptions of the intervention resulted in high retention and good engagement. This study highlights some of the potential uses and effects of digital oral health interventions as they gain traction, especially when combined with more extensive interventions.

Effect on KAPs

Pre- and post-intervention oral health knowledge, attitudes, and practices (KAPs) were, for the most part, considerably altered. An essential component of overall oral health is knowledge. Oral health literacy is defined by the World Health Organization as "the extent to which individuals are able to access, process, and comprehend fundamental health information and services required to make effective oral health decisions" [18]. Better results are associated with higher levels of oral and general health literacy. To prevent and cure disease, enhanced oral health literacy is essential. This includes understanding various disorders, how they present, being aware of the repercussions, and knowing how to obtain and use resources [18]. Interestingly, even though the percentage of participants who identified dental caries as the most prevalent disease in the globe increased significantly between the pretest and post-test, more than half of the participants (54%) were still unable to answer this question after the test accurately. In terms of attitudes, the two attitudes that showed significant shifts between the pretest and post-test focused on the significance of using fluoride toothpaste and the necessity of brushing teeth twice a day. A plausible constraint of the present investigation might be the absence of noteworthy paradigm shifts in attitudes toward other subjects, like the role of sugar in dental caries, the importance of regular dental examinations, and the influence of plaque on dental caries. The baseline evaluations for these views were very high and favourable, suggesting that there is a general consensus regarding the importance of these categories of oral health. About the importance of fluoride, although there is strong evidence supporting the preventive effects of fluoride on dental cavities and widespread support for its use, there is a growing opposition to the use of fluoride-containing products in certain areas. Consequently, it is encouraging to see the shift in attitudes achieved in this study, considering the importance of consistent use of fluoride-containing toothpastes for public health.

Changes in knowledge and attitudes have a greater impact when combined with modifications in oral health behaviours. Practices are the area that will require the most attention going ahead in order to strengthen this intervention, according to both studies.

Table 3. Practices [Kaps]Changes.

| Frequency of brushing | pre | post | PPT change | pre | post | PPT change |
|------------------------------|-----|------|------------|-----|------|------------|
| On some days, I do not brush | 4% | 2% | -2 | 4% | 4% | +0 |
| Once a day | 19% | 18% | -1 | 23% | 14% | -9 |
| Twice a day | 65% | 68% | +3 | 65% | 77% | +12% |
| More than twice a day | 12% | 12% | +0 | 7% | 4% | -3 |

| Frequency of dental visit | pre | post | PPT change | pre | post | PPT changes |
|---|------------|-------------|-------------------|------------|-------------|--------------------|
| Never | 2% | 1% | -1 | 5% | 5% | 0 |
| If there's a problem | 10% | 10% | +0 | 23% | 18% | -7 |
| Once a year | 26% | 23% | -3 | 24% | 21% | -3 |
| Once every 6 months | 61% | 64% | +3 | 42% | 48% | +6A |
| Once every 3 months | 2% | 3% | +1 | 5% | 8% | +3 |
| Use of fluoride toothpaste when brushing | pre | post | PPT change | pre | post | PPT change |
| | 71% | 78% | +7 | 71% | 81% | +10A |
| Frequency of flossing | pre | post | PPT change | pre | post | PPT change |
| Not at all | 33% | 26% | -7 | 30% | 19% | 11A |
| Once a day | 55% | 61% | +6 | 55% | 60% | +5 |
| Twice a day | 9% | 9% | +0 | 9% | 15% | +6A |
| More than twice a day | 3% | 4% | +1 | 5% | 5% | +0 |
| Frequency of using mouthwash | pre | post | PPT change | Pre | post | PPT change |
| Not at all | 33% | 31% | -2 | 34% | 28% | -6 |
| Once a day | 8% | 8% | +0 | 27% | 29% | +2 |
| Twice a day | 28% | 25% | +7A | 18% | 24% | +6 |
| More than twice a day | 2% | 2% | +0 | 1% | 1% | +0 |
| Several times a week | 30% | 25% | -5 | 20% | 17% | -3 |
| Rinse after brushing | pre | post | PPT change | pre | post | PPT change |
| | 87% | 87% | +0 | 92% | 90% | -2 |
| Food/drink after brushing | pre | post | PPT change | pre | post | PPT change |
| Yes, water | 35% | 36% | +1 | 35% | 41% | +6 |
| Yes, milk | 0% | 0% | +0 | 0% | 1% | +1 |
| Yes, other than milk/water | 7% | 4% | -3 | 13% | 10% | -3 |
| no | 48% | 54% | +6 | 45% | 43% | -2 |
| I do not brush my teeth at night | 10% | 6% | -4 | 8% | 4% | -4 |

Long-term behaviour modification calls much more than just following easy-to-follow guidelines. According to the COM-B model, in order to engage in a target behaviour, one needs all three of the necessary elements: motivation, opportunity, and capacity. That helps to explain why some practices haven't seen any notable modifications. Even though more participants in the first study self-reported using mouthwash twice a day, only 25% of individuals said they used it twice a day. Four practices were improved in the second study: the self-reported frequency of brushing with fluoride toothpaste, flossing, and brushing; the intention to visit a dentist every six months. This study does, however, demonstrate that raising awareness through informational campaigns, health risk education, and other tactics such as offering instructions on how to carry out the desired activity or behaviours can still be responsible for some of the early behavioural improvements. In order to better match the intervention to the complex drivers of oral health behaviours and support the achievement and maintenance of larger improvements in habits, further development of this intervention should consider the opportunity and motivation components of the COM-B model.

Most findings from the two studies were repeated in the more homogeneous and diverse population. For instance, the second trial, which included a more diverse sample, showed greater improvements in oral health habits and knowledge. The consistency and repetition of the findings in the two research demonstrate how commonly oral health-related misconceptions, negative attitudes, and subpar oral hygiene habits might be across demographic boundaries. According to the findings of the studies, some issues were still more evident in the more diverse sample. For instance, when it came to the intention of having frequent dental visits, at the follow-up, only 48% of study 2 participants (vs 64% of study 1 participants) said they would visit a dentist twice a year. A greater percentage of study 2 participants (18% versus 10%) said they would visit a dentist more reactively, or "when issues arise," as opposed to proactively. Given the larger concerns about fair, inexpensive, Providing easily available dental treatment both domestically and internationally, this discrepancy is not surprising. Lastly, it is crucial to remember that demographic factors might have a significant impact on an individual's knowledge of oral health and attitudes toward oral health, and behaviours even though they did not change scores pertaining to knowledge, attitudes, or practices. Research on oral health shows strong sociodemographic gradients, with members of underprivileged populations more likely to have poorer oral health knowledge and engage in less-than-optimal oral health behaviours [18, 19]. Although these sociodemographic inequalities show up as differences in habits and knowledge at the individual level, they are really the result of larger societal, structural, political, and economic issues that are outside the direct control of the individual [22, 21]

General health is closely linked to oral health. For instance, general health issues like diabetes and cardiovascular disease are linked to periodontal disease. Individuals suffering from inflammatory systemic

disorders are more susceptible to the development and/or onset of long-term oral health conditions including periodontal disease, which can further exacerbate their overall health conditions [20]. Enhancing knowledge can encourage the adoption of positive oral health behaviours and attitudes that support healthy lifestyles and the promotion of health. This is the aim of oral health education.

Strengths and limitations

A few of the study's merits are its sizable sample size, its ability to collect and make understandable participant feedback and its inclusion of a 7-day follow-up period before KAP completion to compare with baseline. Concerning constraints, an extended follow-up duration would enable the observation of whether KAP alterations persist over an extended length of time. Moreover, the incorporation of many measurements over an extended follow-up duration would enable the investigation of variations in KAPs over time. Future results and the use of validated tools to measure participants' KAPs could both benefit from a more thorough assessment of the KAPs instrument utilized in this study. Additionally, some participants' views scored strongly on the pre-test, which may have predisposed them to better practices. More intricate measurements and analysis of KAPs pre- and post-test should be included in future studies in order to distinguish effects.

This intervention works well since it is digital, however, it restricts the application of more objective assessments in domains such as dental hygiene practices, therefore it is more dependent on participant self-reported metrics. Future research can more thoroughly investigate the reasons for variations in measurements taken before and after the test by include control groups. Given the intervention under investigation, this work, being supported by the industry, may be susceptible to conflicts of interest; nevertheless, a rigorous and transparent process was followed to guarantee an accurate and impartial result.

Future directions

This digital intervention for oral health, in its current form, has proved effective in bringing about a few preliminary modifications to behaviours, perspectives, and understanding. Proceeding ahead, modifications will be made to the material and exam questions to incorporate participant feedback, particularly in the area of specific education on oral hygiene practices such as toothbrushing and flossing. To be more inclusive, non-digital alternatives for individuals who might not have access to digital interventions should be taken into account. This will involve not only content translations but also customization to fit the specific needs of these regions. To increase the effectiveness of this resource as a tool for promoting oral health literacy and inciting behaviour change, the evolution of this intervention should involve a more comprehensive targeting of various regions and elements affecting and altering one's behaviour. Lastly, as previously highlighted here, it is acknowledged that sustained behaviour change requires more than simple instructions on what to do. However, as part of a comprehensive behaviour change intervention, this digital intervention of oral health can serve as a strong, flexible, adaptive resource for information provision and as a public health teaching tool.

V. Conclusion

This study concluded that a digital intervention with an oral health focus could alter participants' beliefs, behaviours, and knowledge. Going forward, to establish evidence for the impact of this project on this material should be expanded from a behaviour change viewpoint and examined longitudinally using a more rigorous methodological approach to ensure long-term changes in oral health literacy and behaviours.

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