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Journal of Geography Education in Africa (JoGEA)

Journal of the Southern African Geography Teachers' Association - sagta.org.za

Staff perceptions of the effects of malodours from toilets at two schools in Gauteng Province, South Africa

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DOI number: https://doi.org/10.46622/jogea.v4i1.2208

Abstract

In any school system, sanitary facilities can have a major effect on the productivity of staff and students, thus safe, adequate sanitation is essential to the academic programme. This study is part of a pilot project to determine the perceptions staff have of the effects of malodours from toilets on productivity and morale, at two schools. One school (School A) is located on the periphery of an urban area and had a septic tank system with inadequate toilet maintenance. The other school (School B) was in a well-established urban area with a flush latrine system, connected to municipal sewage pipes. Through a self-administered questionnaire we determined that School A had a very poor sanitation system that produced unbearable malodours that affected health, productivity and morale at the school, whereas School B had a healthy, well maintained sanitation system that produced little odour. The malodour at School A had a negative effect on pupil attendance and staff morale at the school. The significant finding of the research was that all staff who participated indicated that malodours from either a flush latrine or a septic tank system could affect productivity of staff and students in the school environment.

Keywords: Olfactory perception, school toilet odours, flush toilets, pit latrines.

Introduction

In 2018, a five-year-old child died after falling into a pit-latrine in the Eastern Cape, South Africa (City Press, 2018; Etheridge, 2018), an incident that highlighted the need for adequate and safe sanitation. This need is addressed in the Sustainable Development Goal number 6 which is aimed at ensuring basic water and sanitation for all by 2030 (www.sdgs.un/goals/goal6, 2020; Petterson, 2022). This includes measures that ensure the sustainable use and management of water resources (Chitonge et al., 2020; Petterson, 2022). However, 4.2 billion people live without safely managed sanitation; 673 million still practise open defecation and 3 billion lack access to basic handwashing facilities (WHO/UNICEF, 2019), a situation that was brought to the fore recently by the global COVID-19 pandemic, where handwashing was listed as one of the non-medical interventions required to prevent the spread of the disease (WHO, 2020).

In Africa, sanitation issues are exacerbated by water scarcity and population growth, and whereas populations have grown, water resources have remained constant (Chitonge et al., 2020). In Africa, as in many parts of the world, water is contaminated by sewage and human waste where sanitation services are not managed and maintained adequately (Hamner et al., 2006; Petterson, 2022). As water infrastructures worldwide continue to age, there is growing recognition that water distribution systems are vulnerable to intrusion and contamination and may contribute to endemic and epidemic waterborne disease (Armah, 2018; Abney et al., 2021).

In South Africa, 65% of the population have access to flush toilets connected to municipal reticulation systems, whereas 32% use pit latrines (either ventilated or non-ventilated); and 73% have access to hand-washing facilities (StatsSA, 2019). However, there are still 4 000 schools in the country with inadequate sanitation facilities. A major issue with toilet facilities are the emitted odours, and the unsanitary and unhealthy conditions of the toilets (Adegbenro, 2007; Evans et al., 2020). Malodours can cause a great deal of discomfort as people who avoid using either flush or pit latrines may risk contracting urinary tract infections (UTIs) and constipation, amongst other health problems (Lundblad et al., 2005). Evans et al. (2020) quantified the perception of odours of the school toilets, through an olfactory test, and determined that

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bioremediation treatments could improve the conditions of these toilets. The Evans et al. (2020) study was the first part of a pilot project on the state of sanitation at two school in Gauteng Province, South Africa: one with a pit latrine and the other a flush system. Here, we present a continuation of that study at the same two schools where we examine the perceptions that staff have of the effect of toilet odours on staff and students at each school. The rationale is that physical issues such as menstruation, and mental health issues such as mood, judgement, interpersonal relationships, anxiety, absenteeism and participation of students and staff in school activities can be negatively affected by malodours and unsanitary conditions of flush, septic tank flush toilets and pit latrines (Herz, 2002; Grant et al., 2013; Chung et al., 2019).

Malodours and the effects from regular flush and septic tank latrines

There are two types of latrines used worldwide within developing and developed countries, which are septic tank/pit latrines and flush latrines (Igbinovia et al., 2016; Nakagiri et al., 2016). Approximately 1.77 billion people globally, use pit latrines as a main source of sanitation (Graham and Polizzotto, 2013) and there is growing concern that the release of unsanitary chemicals and microbial contaminants from these pit latrines affects human health and can contaminate ground water (Graham and Polizzotto, 2013). Similarly, conventional flush latrines, if not flushed quickly enough, will emit odours and aerosols into the bathroom environment, in particular if there is no proper ventilation in the bathroom or toilet structure themselves (Saeed et al., 2018; Abney et al., 2021). These odours and pathogen-carrying aerosols can then enter other parts of a building through open doors (Nakagiri et al., 2015; Abney et al., 2021). In addition, odours can attract insects and disease-carrying flies, which are highly undesirable (Graczyk et al., 2003; Nakagiri et al., 2015; Mbazor et al., 2018).

The Research Sites: School A and School B

In schools, degrading conditions of school sanitation hinders students' ability to learn, exposes them to health risks, and infringes on their safety. Maintenance and sanitation are crucial for a safe learning environment and access to adequate sanitation reduces the risk of disease, enhances

quality of life and maintains personal dignity (Sibiya and Gumbo, 2013). The research was conducted at two schools in Gauteng Province, South Africa. The details of these schools are described in Evans et al. (2020). School A is located in a peri-urban area, north of Pretoria and is ranked as a Quintile 1[1] school. It is a secondary school with a pupil enrolment of 1180 learners and 42 staff members. The normal ratio of toilets available to the learners is 1:49, if all toilets are functional. However, during the study period a number of toilets were being repaired and the ratio was increased to 1:69 (Evans et al. 2020). This ratio far exceeds the maximum ratio of 1:34 as set out in the South African Schools Act 84 of 1996 (Motshekga, 2009). School A was selected as it had a septic tank system and was willing to participate in the study. School B is a primary school with an enrolment of 569 students of which 277 are boys and 292 are girls. It is located in an urban metropolitan area, east of the central business district of Johannesburg, with well-established infrastructure and is ranked as a Quintile 51 school (https://www.education.gov.za/Programmes/EMIS/EMIS Downloads.aspx). This school had flushing toilets connected to municipal sewer systems and also agreed to participate in the study.

At School A there were 15 toilets (three in-operable) for the girls, and 15 toilets (six in-operable) and four urinals for the boys. The students' bathroom was unpleasant with broken sinks, toilet rolls in the sinks, and untidy bathrooms (Figure 1). The facilities consist of flush toilets connected to a septic tank system. However, the latrines did not flush mechanically as there was no water connected to the cisterns resulting in an accumulation of faeces and urine at the bottom of the toilet bowl. The staff's toilets were also connected to the nearby septic tank, but hand basins were not available due the lack of running water. There were three staff toilets for men and three for women and these facilities were cleaner than the students' facilities. The toilets were claimed to be cleaned twice a day for staff and students. However, the students' toilets were in very poor condition. Both staff and students use a bucket system to wash their hands, and the toilets are flushed manually by pouring water from a bucket into the cisterns. Students had free use of the toilets when required, however cleaners were not always available to monitor the cleanliness of the toilets.

[1]Government subsidies are allocated to schools based on the Quintile System which ranks schools according to their socio-economic profiles. The ranking starts with Quintile 1 schools being the poorest up to Quintile 5 schools being the wealthiest (Bell & McKay, 2011; https://www.education.gov.za/Programmes/EMIS/EMISDownloads.aspx).

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Figure 1: Unsightly conditions of toilets at School A. The black bin is used to store water with chemicals used to flush the toilets throughout the day. (Photos: Kyle Odgers, 2018)

At School B, the toilets are cleaned between three and five times a day with no unpleasant odour coming from the bathrooms or general work environment. School B appeared to have a high standard of sanitation and cleanliness in the bathroom and toilet facilities. This school had flushing toilets connected to the municipal water and sewage networks, with students' toilets as clean and free from unpleasant odour as the staff's toilets. There was also signage encouraging good overall hygiene and sanitation. Hand basins worked with warm and cold water and soap was available. For both gender's toilets, the ratio of students to toilets was much lower than School A. Students were not given access to toilets during class time, except for emergencies. Cleaners were constantly in the vicinity of the toilets to ensure that the conditions were not allowed to deteriorate. Toilet aeration and deodorisation was maximised through adequate ventilation together with an industrial deodoriser. The conditions of the toilets were tolerable (Evans et al., 2020)

Figure 2: Condition of toilets at School B where bathroom stalls were cleaned regularly (Photos: Kyle Odgers, 2018)

Methods

The focus of this study was to assess the staff perceptions of the schools' toilet odours and conditions and how it may have impacted their work experience (where staff included teachers, cleaners, grounds people, principal, deputy principal, security guards and kitchen staff). This was done in the form of a self-administered questionnaire. The data were collected after the schools' mid-year holiday, when the teachers and other members of staff were not under pressure with exam and parent conferences. As this research took place during school hours we had to be considerate of the participants' time and availability, whilst understanding that they were only able to spend a maximum of ten minutes answering the questionnaire.

Schools were visited on separate days within a week of each other. At School A, we approached the staff members individually, throughout the day, when they had ten minutes to complete the questionnaire. At School B, a staff meeting was called, the research was explained to the group of participants after which they completed the questionnaire. Through the questionnaire we wanted to determine the effect of toilet odours on productivity, morale, attendance and overall health of staff and to establish the strategies that each school employed to manage these odours. The questionnaire used both Likert-scale type questions and open-ended questions to provide further insight into the participants' particular attitudes, feelings and perceptions.

Permission was granted by both the Gauteng Department of Education

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and the principal of each school. A formal meeting was scheduled with the principal at School B to discuss the research and the research process. As a result of the distance to School A, a similar meeting with the principal was conducted over the phone. Before any data were collected, the participants were provided with information and instructions regarding the research and signed a consent form. All data were gathered anonymously and any identifiers to any participant was removed. A total of 44 respondents participated in the research, 24 from School A, and 20 from School B.

Results and Discussion

School A had 13% of the participants in the 18-30 age category, whereas School B had none (Figure 3). However, School B had more participants in the 30-40 category (35%) compared to only 17% for School A. Both schools had almost half the participants in the 40-50 year age category. Of the participants, 54% were female at School A compared to 85% at School B. These demographics are important as odours are perceived differently by different individuals, based on their gender and age (Larsson et al., 2000; Talaiekhozani et al., 2016; Evans et al., 2020).

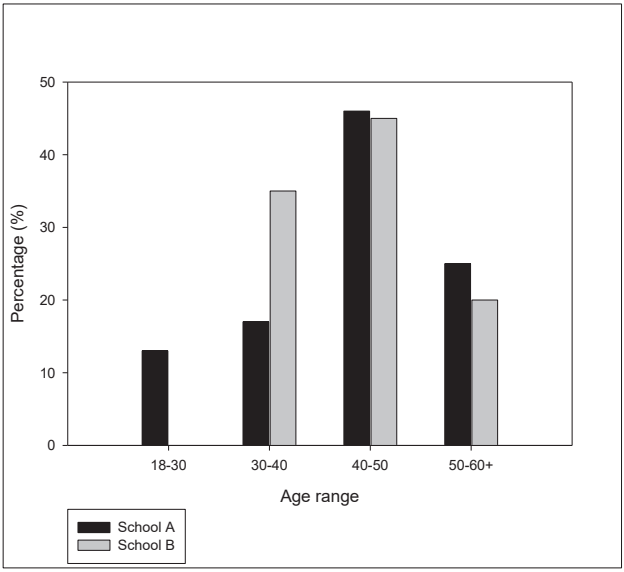

Figure 3: Age distribution of staff at School A and School B.

The participants were asked to rate the conditions of the toilets at their school as either "poor", "bearable", "satisfactory" or "good". The percentage of staff at School A who described the toilet conditions as "poor" was 75%, and "bearable" was 25% (Figure 4). The categories of 'satisfactory" and "good" were not chosen as an option by any of the participants. In contrast, conditions of the toilets at School B were considered more favourably with 0% describing it as "poor" and 15% as bearable. Most of the participants at School B thought the toilet condition was "satisfactory" (60%) or "good" (25%).

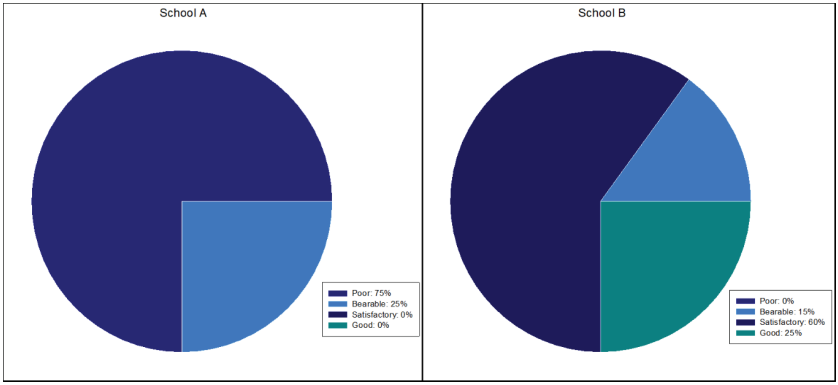

Figure 4: Rating of the conditions of the school toilets.

When the participants were asked if they considered the toilet odours to be a negative issue in the school, 83% at School A indicated that it was, whereas only 35% at School B considered this to be a problem. However, at School A the participants felt that the toilet odours were frequently a problem, with 58% responding that malodours were always an issue (Figure 5).

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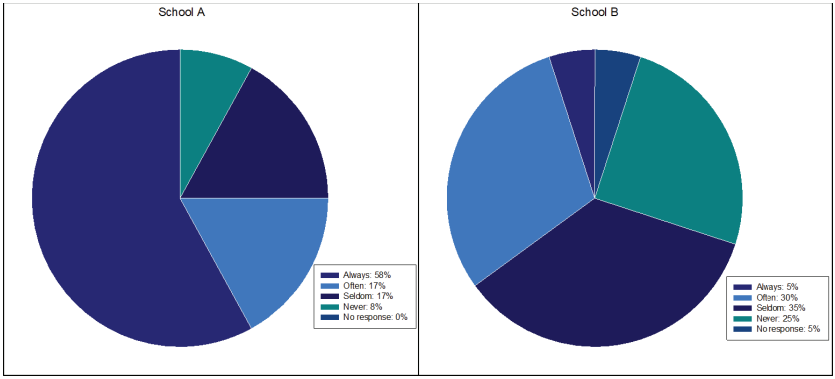

Figure 5: Frequency with which malodours are considered a problem..

Participants were asked whether they felt that the odours had a direct effect on the staff and students at the school and what that effect could be. For School A, 75% of the participants reported that odours have a direct effect on staff and students, whereas 25% reported that the toilet odours did not have an effect. In contrast, 45% of the participants at School B felt that odours do have a direct effect on the school; 35% said that it did not have an effect and 20% did not respond to this question. Participants were then asked whether odours affected productivity, health, staff and pupil attendance and morale. It is interesting to note that at both schools, 25% of participants felt that morale was affected by the odours (Figure 6). This is despite the fact that School B reported better toilet conditions than School A. School A however, reported that both productivity and staff attendance were directly impacted by odours, whereas School B reported that these were not impacted at all.

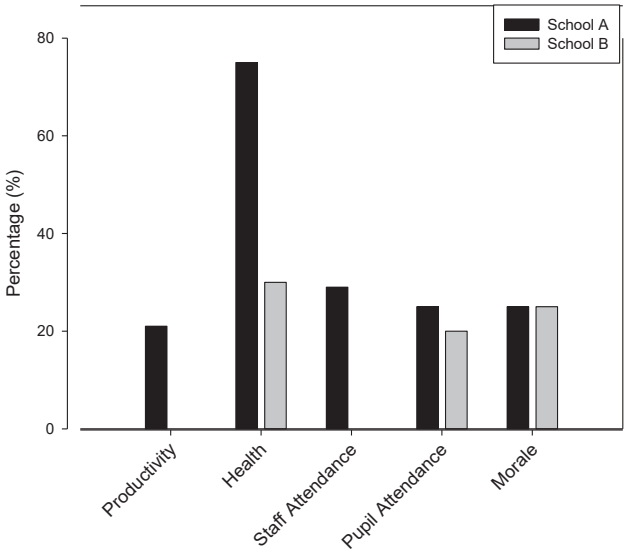

Figure 6: The direct effects of malodours on staff and students at the schools.

Some of the ways to manage the odours from the school toilets include regular cleaning, using masking agents like air fresheners or even creating awareness of cleanliness by using explanatory signs. School B reported that all these strategies were used to a greater or lesser extent (Figure 7). However, School A reported that these strategies are not often used and that no explanatory signs were available to create awareness of the need for cleanliness.

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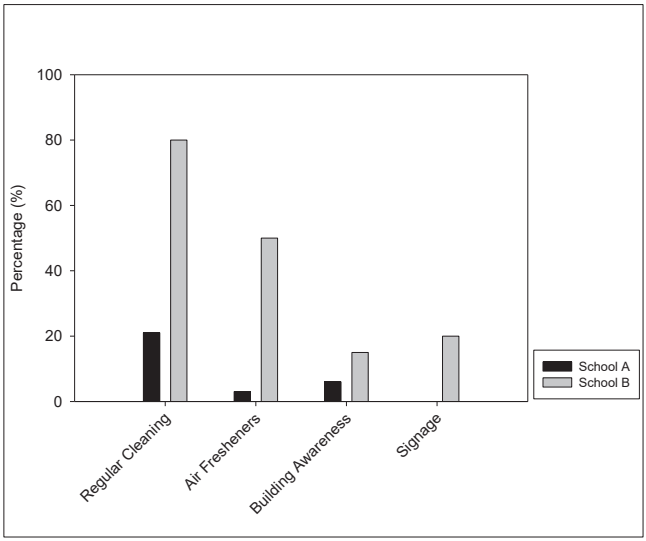

Figure 7: Strategies to manage toilet odours at both schools.

It was clear that participants at School A considered the toilets to be in a poor condition, describing them as "not clean", "poor", and "sickening" and unhygienic with the smell being "very bad for our lives". The participants also referred to the maintenance as poor, indicating that the toilets did not flush and that they "need to be fixed" or are "dysfunctional". A major concern for most of the participants at School A was the lack of running water in the bathrooms. A bucket system was used for collecting water to wash hands and flush the toilets. This problem came about when the school was rezoned from the North West Province into Gauteng. The pit latrines were changed to flush toilets but these were not connected to the main reticulation system. Instead the toilets were connected to the existing septic tank, creating this unpleasant situation. Participants noted that the poor sanitation was not conducive to a good learning environment as the toilet conditions produce a "diabolic smell" (Interviews).

When participants at School A were asked about their perception of how toilet odours affect school activities, the overwhelming sense was that it resulted in "poor quality of learning". This was supported by comments that

"learners suffer every day", and "time is wasted collecting water in a bucket for hygiene". In addition, it was stated that "when the smell reaches the class, the learners are affected" and "learners hold it (urine or faeces) in, affecting their concentration". Staff concurred that collecting water for the flush bucket was a waste of class time as "we are always wasting time putting water into buckets, thereby taking up time to attend the whole class" and "it's always time consuming filling the buckets of water". It was further noted that staff members leave the building to relieve themselves elsewhere, such as the toilets of a nearby shopping mall as "going to the toilet becomes difficult but in the end one has to go, so some educators feel they cannot and instead go to the mall toilet".

Staff morale is low as they mentioned that they dislike coming into work because of the smell factor. One participant stated that "the filling of buckets with water not only wastes time but affects their happiness at the work". In addition, staff felt that their health was negatively impacted as a result of the toilet conditions and cited respiratory problems such as asthma and sinus related issues. They also feared illness relating to pathogens as "germs can grow and affect our health" and it was "harmful" and "not healthy to inhale". An unforeseen consequence of the poor conditions of the toilets was that "the foul smell might affect visitors and future business of the school".

The discussion of the toilets at School B revealed that the participants thought the toilets were "always clean" and they acknowledged that someone is always on duty cleaning the toilets including "a parent is on duty at all times to keep the toilet clean". The toilets were described as being in "good condition", "not bad" and "well maintained", "they are in good condition for the boys' and girls' toilets too" and "they are in reasonable condition with no smell". Most of the participants stated that the toilets had no smell. However, two participants did state that the toilets produced an unpleasant smell: "the smell is not always pleasant, some learners don't use it properly" and "the toilets are cleaned most of the time, but the smell is not always good".

When participants at School B were asked their perspectives on how toilet odours affected school activities it was noted that poor attendance was a concern. Where toilets were located in close proximity to the classrooms the odours were "unbearable for learners and staff" and "the kids would not like to come to school on the days the toilet

ISSN: 2517- 9861

smells bad". This was supported by "the toilets affect attendance because if they are in bad condition, the learners get sick and stay at home". Participants were concerned about infections in the body caused by "holding as long as possible". This affects the pupils' learning outcomes since they "hesitate to smell the odours". These health implication are noted by the statement that "it can cause infections to other children" and "when the toilet has a bad odour, learners do not use it and choose to hold it, and that might affect them".

The discrepancy in the perception of odours between the two schools relates to access to adequate water supply and cleaning services, structural maintenance of bathrooms and financial resources. School B noted parental involvement in keeping the toilets clean. However, despite the contrast between the two schools, both noted that staff morale and pupil attendance were affected by the odours from toilets. School A noted that there is a noticeable effect on productivity and health from malodours.

The achievement of Sustainable Development Goal number 6, of providing adequate water and sanitation to all by 2030 is critical. However, during the last decade, South Africa has had mixed success with the provision of safe sanitation, and water supply, especially within the country's rural communities (Sibiya and Gumbo, 2013); and while this is only a micro-study conducted on two schools it highlights that some schools and areas are struggling with adequate sanitation and water supply and this has a noticeable effect on academic success.

Conclusion

The aim of this study was to investigate the perceptions of school staff of the extent and effects of odours from flush and septic tank latrines at two schools. The two schools were different in terms of location, infrastructure and fees standards. School A was located in a peri-urban area with basic sanitation facilities. School B was in an urban area with adequate infrastructure and maintained a strong standard of awareness of sanitation. Participants from School A noted that the conditions of the toilets were unsatisfactory, they were not cleaned regularly and had a negative effect on both staff and students. The areas most negatively affected were productivity, morale and health.

In contrast, participants at School B found the conditions for the toilets to be good and satisfactory, and a

few mentioned bearable. Half of the participants stated that toilets produced a foul odour, and they indicated that productivity and morale were mostly affected by the odours. These were common themes that emerged from all the participants of both schools. They felt that students cannot concentrate if sanitation is poor, and that they cannot work in a non-conducive environment if their morale is very low.

Both schools were government-funded schools under the administration of the Gauteng Department of Education. School B met the standards of the education system and national health and safety procedures. But School A struggled with maintaining high quality infrastructure standards resulting in poor toilet facilities, seemingly unhygienic conditions with water pipes leading to the septic tanks. This has resulted in a lack of flushing water in the bathroom facilities. Water had to be fetched and carried, reducing the time available for teaching and participation in classroom activities. Staff and students often do not attend school due to the foul odours and inadequate bathroom facilities, and some students that do attend school do not use the bathrooms at all. Staff stated that they prefer using toilets at the shopping mall on days when the odours are unbearable. South Africa is a developing country with a history of inequality. To build a nation requires a strong economy and hope for a prosperous future which includes providing safe and adequate sanitation facilities for all. The success of this pilot study (including Evans et al., 2020) provides the protocols to expand the study across the country to assess the sanitation needs and effects on schools in other provinces.

Acknowledgements

The staff member of the schools who participated in this study, although anonymous, are thanked for their willingness to participate. We are grateful to Ms Glynis Martin for her editorial assistance; and we thank the anonymous reviewers whose comments helped improve the quality of this manuscript.

Ethics clearance was provided by the Gauteng Department of Basic Education and the University of the Witwatersrand. Ethics protocol number: 4-2018-0012.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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