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**An analysis of how the introduction of a lottery-based token
reinforcement system impacts upon behaviour
in a Year 7 mathematics lesson**

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Abstract

A raffle ticket-based lottery token economy was found to be a potentially useful system for promoting positive pupil behaviours in a Year 7 mathematics lesson. This behaviour management system is both cost effective and easy to implement, making it a potentially useful tool for teachers (particularly those teachers who find implementing behaviour management systems difficult). The negative behaviour of two pupils (who typically struggle to regulate their behaviour) appeared to improve significantly following the introduction of the raffle ticket-based lottery token economy. Unfortunately, the closure of schools in England (due to the 2020 COVID-19 lockdown) resulted in many variables across the two lessons (with and without the raffle ticket-based lottery token economy). Therefore, the study was unable to yield any conclusions regarding the effectiveness of the system.

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Introduction

A recent survey of teachers concluded that “persistent disruption in England’s schools is a serious problem” (Williams, 2018, p.6) and that “three quarters of teachers say they commonly experience disruption in their own school” (Williams, 2018, p.6). The report also recommended that trainee teachers should be taught more techniques for managing pupil behaviour. From my own experience as a trainee teacher and from discussions with fellow trainees, behaviour management is a source of huge anxiety and worry for new teachers. It is my belief that most of this anxiety comes from new teachers not having actual systems that they can implement in classrooms in order to reduce negative behaviours. If teachers could be told the practicalities of a simple behaviour management strategy to implement in their lessons (ideally low cost and simple to implement) much of this anxiety could be alleviated.

The aim of this research was to try to partly address this issue through testing the impact of a variation of a token response system on the behaviour of a Year 7 mathematics class. The benefits of the system are that it is incredibly cost effective, it requires no specialist training for staff and it can be used with individual classes as it does not require school-wide implementation. The aim of the research was to understand how the introduction of a lottery-based token reinforcement system impacts upon both positive and negative behaviour in a Year 7 mathematics lesson.

A mathematics lesson was taught to a Year 7 mixed-ability class in a city centre school, the class contained two pupils who were on report for their behaviour (identified by the school). Pupil behaviour was monitored using several metrics: individual pupil motivation, entire class negative behaviour and my own reflections. The behaviour was then monitored in the subsequent lesson (with the introduction of the new lottery-based token reinforcement system). This involved

rewarding positive behaviours with a raffle ticket and at the end of the lesson a prize draw was made. The pupil with the winning ticket was able to choose a low value prize.

This paper outlines previous studies and the psychology of token reinforcement systems used in schools. A description of the research methodology is broken down into two main sections. Firstly, the initial research design sets out the intended plan for introducing the lottery-based token reinforcement system to the Year 7 class (prior to an unexpected school closure). The changes to the methodology (due to the school closures) are then discussed alongside the limitations of making these changes to the research design. The behaviour of the class (with and without the lottery-based token reinforcement system) is presented. Unfortunately, due to the limitations of the research design it is not possible to make any recommendations regarding the use of the lottery-based token reinforcement system as an effective behaviour management system.

Literature Review

This section outlines why negative behaviour is such an issue in schools and the different interventions that can be used to mitigate it. The review primarily focuses upon token economies and the different variations that have been shown to be successful at reducing negative behaviours in school classrooms. The psychology behind these systems and current gaps in the research is discussed.

Why is negative behaviour an issue in schools?

Negative behaviours can range from a serious breakdown of school culture (e.g. violence towards staff) (Bennett, 2017) to a range of low level disruptions (e.g. calling out) (Ofsted, 2014). This study is focused on reducing the occurrence of low-level disruptions in a secondary school mathematics classroom, hence this review will focus on these behaviours. Low level disruptive behaviour can be defined as:

“Talking unnecessarily or chatting, calling out without permission, being slow to start work or follow instructions, showing a lack of respect for each other and staff, not bringing the right equipment or using mobile devices inappropriately.”

(Ofsted, 2014, p.4)

It has been claimed that pupils potentially lose up to an hour’s learning each day due to these low-level disruptive behaviours (Ofsted, 2014). A recent independent review, that focused on how

schools can optimise behaviour, made the following statement: “is there a national problem with behaviour? The evidence suggests that there is” (Bennett, 2017, p.14).

Negative behaviour in schools is an important national issue with successive governments making tackling it a top priority (Williams, 2018). The aims of education are not universally agreed upon, but they typically centre around the following principles: academic education, dissemination of good character and workforce preparation. All these aims are much easier to achieve in schools in which positive behaviours are more prevalent than negative behaviours (Bennett, 2017).

Different types of behavioural intervention

A significant amount of research has been conducted to assess the effectiveness of different types of behavioural interventions in order to decrease disruptive classroom behaviours. Over the past century there have been many different types of interventions that have been shown to be successful in reducing negative behaviours (Stage & Quiroz, 1997). Some of the more commonly used interventions are discussed below.

Punishment procedures

Punishment procedures have been shown to decrease disruptive behaviours (Stage & Quiroz, 1997). Examples of punishment procedures include (but are not limited to):

- Isolation timeout involves removing the student from the classroom to a seclusion room. Despite the procedure being prone to abuse (Harris, 1984) it is still used extensively in schools with a 2017 independent review commissioned by the UK government stating that “removal rooms and internal exclusions may result in positive student outcomes” (Bennett, 2017, p.71). There is currently a growing ‘ban the booth’ campaign in the UK, with a Member of Parliament recently labelling the use of isolation booths as “cruel and demeaning for children” and that they “undermine those children’s self-esteem and ability to progress” (Mersinoglu, 2020, p.1).
- Overcorrection requires a pupil to retry an action with corrected behaviour instead of the negative behaviour that they originally demonstrated (Foxy, 1978).

Token reinforcement systems

Token reinforcement systems involve rewarding positive behaviours with a token (which is then usually exchanged for something of value to a pupil). The reward can vary from something as simple as extra free time (Ma, 2010) to complicated systems involving monetary incentives (Burgess, Metcalfe & Sadoff, 2016). Token economies can be used to reward positive behaviours, whilst completely ignoring negative behaviours. Alternatively, negative behaviours can be punished by revoking rewards; this is known as a response cost system (Stage & Quiroz, 1997).

Cognitive behavioural interventions

Cognitive behavioural interventions are a wide range of interventions including (but not limited to) anger management, social problem solving, relaxation training and affective imagery (Stage & Quiroz, 1997). These interventions are usually self-instructional training programmes targeted at aggressive pupils (Stage & Quiroz, 1997); these interventions have been shown to not always result in a reduction of negative behaviours (Larson, 1992).

What is a token system?

A token system is defined as “a contingency management system that allows participants to earn tokens for presenting specific, positive behaviours that are later exchanged for predetermined backup reinforcement” (Maggin, Chafouleas, Goddard & Johnson, 2011, p.530). Token systems have been identified as an effective evidence-based classroom management tool (Simonsen, Fairbanks, Briesch, Myers & Sugai, 2008). In the classroom the prevailing goal of token systems should be the development of self-regulation in the desired behaviours; pupils should eventually be able to manage behaviours without the use of the tokens (Kuypers, Becker & O’Leary, 1968).

History of token systems in schools

Token systems have been used in educational settings for over two-hundred years. In New York in 1805 pupils were awarded leather tickets of merit based upon academic performance. These leather tokens could be exchanged for different sets of prizes and privileges based upon the level that they had been given (Kazdin & Pulaski, 1977). The use of a backup reinforcer (in this case a prize or

privilege) greatly increased the tokens' ability to affect behaviour (Doll, McLaughlin & Barreto, 2013).

Implementing a successful token system

For a token system to be effective, careful consideration of a range of different factors is required. The teacher or school implementing the system must ensure that explicit rules and procedures are in place prior to the introduction of the system (Maggin et al., 2011). The importance of thorough planning cannot be understated: "without thorough planning and explicit descriptions of behavioural expectations and contingencies, educators will likely not realize significant benefits from the use of token economy or other behaviour modification programs" (Maggin et al., 2011, p.550). It is important that the target behaviours are reinforced frequently over an extended period until each of the positive behaviours are established (Chaplain, 2017).

In order to implement a successful token system, the token will need to be exchanged for some sort of prize or reward (a reinforcer). It does not matter what the reward is, and as long as it is desirable to the pupil it can be classed as a reinforcer (Chaplain, 2017). The selection of the reinforcer should be carefully considered and should be chosen based upon the nature of the school and the impact it has upon behaviour. If a token and the subsequent reinforcer are to be successful in promoting desirable behaviours then the following guidelines should be adhered to (Chaplain, 2017):

- The desired behaviour should be acknowledged with a token as soon as possible.
- When issuing the token, a statement should be made to the pupil explaining the positive behaviour that they are being rewarded for displaying.
- Eye contact (an effective reinforcer in itself) should be made with the pupil when the token is issued.
- If the chosen reinforcers lose their effectiveness, then they must be changed to something more desirable.
- The anticipation of the pupils should be kept to a maximum when the reinforcers are issued (e.g. using brightly coloured containers for prizes).

It is also important to consider how frequently tokens can be exchanged for reinforcers by the pupils, with some studies performing exchanges as often as once every two hours (Zlomke & Zlomke, 2003).

Examples of successful classroom token systems

Previous research has shown that token reinforcement systems have been successfully implemented in a range of educational institutions, including pre-schools/nurseries (Filcheck, McNeil, Greco & Bernard, 2004), primary schools (Boegli & Wasik, 1978), secondary schools (Burgess et al., 2016) and universities (Boniecki & Moore, 2003). A recent review found that “behavioural interventions, based on token systems involving the whole class or group, appear to be effective in controlling off-task and disruptive behaviour in the short term” (Harden, Thomas, Evans, Scanlon & Sinclair, 2003, p.12). In addition to entire classes, token reinforcement systems have been shown to successfully reduce negative behaviours in individual pupils (Higgins, Williams & McLaughlin, 2001; Zlomke & Zlomke, 2003). They have also been implemented effectively on larger scales; including entire secondary school year groups (~150 pupils) (Burgess et al., 2016) and entire primary schools (~450 pupils) (Boegli & Wasik, 1978).

The psychology behind token reinforcement system

As previously discussed, a token reinforcement system involves rewarding pupils with tokens for displaying target positive behaviours. In order to give the tokens meaning they must then be exchangeable for something desired by the pupil (a reinforcer) (Maggin et al., 2011). By linking the tokens to a desirable reinforcer in this way, the token itself acquires a symbolic value to the pupils (analogous to currency in a monetary system) (Wolery, Bailey & Sugai, 1988). This leads to the tokens themselves becoming reinforcers for positive behaviours. This gives teachers the ability to frequently reinforce positive behaviours using a token (which costs virtually nothing) rather than an actual reward which may not be practical (e.g. extended free time) or may cost money (e.g. stationery) (Maggin et al., 2011). The use of token reinforcement systems to modify pupil behaviour is in alignment with the principles of many other behaviour modification programmes (Wolery et al., 1988):

1. Target behaviours are identified.
2. Tokens are identified for conditioned reinforcement.
3. Backup reinforcers are created to award the appropriate behaviours.
4. The conditions for exchanging the tokens for the reinforcers are decided upon.
5. Procedures are developed in order to phase out the use of the token economy (leaving pupils with the ability to self-reinforce positive behaviours).

Examples of token reinforcers

Choosing the correct reinforcer is of huge significance when designing a token reinforcement system; it has been shown that the impact on behaviour is higher when a favoured reinforcer is used (Neef & Lutz, 2001). Each pupil will respond differently to various rewards and incentives (i.e. reinforcers) and teachers should be prepared to change reinforcers based upon the needs of classes, individual pupils and the effectiveness of the current reinforcers (Chaplain, 2017).

Reinforcers can be broadly categorised as positive and negative. Positive reinforcement involves giving the pupil something which they desire, this includes (Ma, 2010):

- Edible foods (e.g. sweets).
- Tangible objects (e.g. school equipment).
- Activities (e.g. extra time on special activities).
- The token itself (pupils have kept the raffle tickets they have been given as tokens and stuck them on pinboards at home (Chaplain, 2017)).

Negative reinforcement can be achieved through either issuing pupils with negative reinforcers or withdrawing positive reinforcers (Ma, 2010):

- Negative reinforcers involve giving pupils aversive stimulus. Examples include reprimanding pupils, overcorrection and loud noises.
- Withdrawing positive reinforcers involves depriving the pupil of something which they find desirable. For example, removing the pupil from a desirable situation (timeout), withdrawal of attention or the removal of previously awarded tokens (response-cost system).

Ma (2010, p.398) performed a “meta-analysis of single-case experiments to compare the relative effectiveness of different kinds of reinforcers used in behaviour modification” and concluded that activities were the most effective positive reinforcer for modifying behaviour. It is also important to note that extrinsic reinforcement (i.e. reinforcers) are not harmful to the intrinsic motivation (the inherent interest in pursuing a topic) of pupils (Cameron & Pierce, 1994).

Current gaps in research

Token reinforcement systems have been shown to be effective at both increasing target behaviours and decreasing undesirable behaviours. Previous studies have focused more on younger pupils (primary school and preschool); future work should expand upon this and focus more on the effect of these systems on older pupils (secondary school) (Doll et al., 2013). More research should be conducted into the long-term effects of token reinforcement systems and the impact they have upon target behaviours in the long term (over a year after the token systems have been phased out). It would also be useful for teachers to have strategies informing them about how they can continue to develop and expand upon the positive benefits achieved from the introduction of the token reinforcement system (Doll et al., 2013). Equipping teachers (trainees in particular) with clear instructions for introducing token reinforcement systems in their lessons in order to deal with problem behaviours could potentially be of great benefit to schools, teachers and pupils. Equipping teachers with a simple and effective behaviour management system, which they are confident introducing, could lead to teachers spending less time dealing with negative behaviour. This could potentially reduce teacher stress (benefiting teachers), increase teacher retention (benefiting schools) and decrease the time spent dealing with negative behaviour in lessons (improving pupil learning).

Research Design and Methods

The Research Question asks how does the introduction of a lottery-based token reinforcement system impact upon both the positive and negative behaviour in a Year 7 mathematics class?

The methodological approach of the project took the form of action research. It involved teaching a Year 7 mathematics class a 'typical lesson'. A new reward system was then introduced involving a variation on a token economy called a lottery system (Doll et al., 2013). This involved giving raffle tickets to pupils to reward positive behaviours. A raffle draw was then held at the end of the lesson with the winning pupil allowed to choose a small prize of sweets or stationery. The study consisted of the following lessons:

- An initial 'standard lesson' which followed the school's scheme of work. The school's standard behaviour policy was followed and negative behaviour was punished in accordance

with this. The school's reward system (positive points for excellent work or effort) was not used. Pupil behaviour and motivation were assessed using several metrics.

- A second lesson was then taught using the raffle ticket system. This lesson also followed the school's scheme of work and negative behaviour was punished using the school's behaviour policy. Crucially, pupil behaviour and motivation were once again assessed using the same metrics used in the previous lesson.

The raffle ticket system

Several different forms of token economies have been shown to be effective at producing desired behaviours in classroom settings. For this study a lottery system was used for its simplicity- it does not require complex exchange rates for pupils with a variety of different value prizes and unlike other token systems the lottery system does not require any significant administrative effort from teachers. The system is also very cost effective as just one prize is given out at the end of every lesson (Doll et al., 2013). Raffle tickets were given to any pupils who exhibited positive behaviours. There was not a limit to how many tickets each pupil could earn. The raffle tickets were introduced after the first five minutes of the second lesson and it was explained to the pupils that good behaviour (working well and being on task) would be rewarded with a raffle ticket. At the end of the lesson there would then be a draw, and someone would win a prize. No further details were given to the pupils.

The school and the lesson plans

Both lessons were taught to the same Year 7 mathematics class in a city-centre school. The school is a non-selective state school with less than 1,000 pupils on roll. The school does not set its Year 7 pupils based on their mathematical ability. A lesson was taught according to the school's scheme of work. The lesson topics were different for each lesson; expanding and factorising was taught in the first lesson and comparing fractions and decimals was the topic in the second lesson. Each 50-minute lesson followed a very similar structure:

1. The first five minutes were spent completing a starter activity whilst waiting for all of the pupils to arrive from their previous lesson.
2. The following 10-15 minutes were then spent listening to the teacher explaining the topic.

3. Pupils were then given the rest of the lesson to attempt questions (30-35 minutes).
4. The final two minutes of the lesson were spent performing the raffle draw.

All raffle tickets were given to pupils throughout part three of the lesson; they were introduced after the first five minutes (so could not be used in part one of the lesson) and it is very difficult to administer tickets when explaining the topic (part two of the lesson). They were administered for exhibiting 'good behaviours'; these included but were not limited to working well individually and having sensible on-topic discussions. When each raffle ticket was issued, the desired positive behaviour that the pupil exhibited was orally communicated by the teacher (as recommended by several authors (Alberto & Troutman, 2013; Cooper, Heron & Heward, 2007; Witt, Elliott & Gresham, 1988)).

The raffle was drawn at the end of each lesson as it has been shown that frequent exchange periods (i.e. the raffle draw) are a vital component of successful token economies. This allows pupils to be quickly reinforced and therefore increases target behaviours (O'Leary & Drabman, 1971). The winning pupil was given a choice of prizes, either sweets or stationery, as it has been shown that higher response rates occur when tokens can be exchanged for a selection of favoured rewards (Kazdin, 1977; Sran & Borrero, 2010).

It is important to note that the positive reward system (raffle tickets) was kept entirely separate from the school's negative behaviour system. Negative behaviour was still punished in accordance with the school's behaviour policy. Raffle tickets were not confiscated for negative behaviour (as they would be in a response-cost token economy) because:

- The use of punishment (rather than reward) can result in undesirable side effects (Kazdin, 1975).
- It has been shown that the threat of token removal can result in inverse reactions to the token system by some individuals (Boren & Colman, 1970).

Metrics for assessing pupil motivation and behaviour

Individual pupil motivation

The motivation of two individual pupils was assessed. Both pupils are currently on school report that requires teachers to review the pupils on three criteria at the end of each lesson. The justification for using this metric is to help understand the effect of raffle tickets on pupils who are already frequently exhibiting negative behaviours. The three targets used were decided upon by their form teacher and are not specific to mathematics lessons:

1. Stay focused throughout the lesson.
2. To complete all tasks to the best of my ability.
3. To put my hand up when I would like to talk.

Each target was scored from 1-3 at the end of each lesson by the teacher (1 = excellent, 2 = good, 3 = inadequate).

Entire class negative behaviour

Counting the number of off-task behaviours is a direct way to measure negative behaviour and shows the impact of the raffle ticket system upon the number of negative behavioural incidents. Therefore, the usual class teacher was asked to sit at the back of the classroom and keep a behaviour tally chart throughout both lessons (whilst I taught the lesson). The chart recorded each time a pupil was off task and used a coding system and interval system based upon the study performed by Higgins, Williams and McLaughlin (2001). The lesson was split into five-minute intervals and each pupil could be marked once for each of the three disruptive behaviours in an interval. In order to make the task manageable for the observing teacher, pupil disengagement was measured through incidents of pupils lying on their desk. Other nondisruptive activities such as those outlined by Boegli and Wasik (1978) (e.g. daydreaming or gazing out of the window) were not marked down. The first two criteria were intended to measure negative behaviours and the third was intended to measure pupil disengagement. The criteria used were:

1. Pupil being out of seat without permission (a gross motor behaviour (Kuypers et al., 1968)).
2. Pupil talking out loud without being called upon (verbalisations (Kuypers et al., 1968)).
3. Pupil lying on the desk.

The tally chart that was used is shown in Figure 1. A trial lesson was performed in which the tally chart and three behaviour criteria were piloted in a Year 9 lesson with approximately the same number of students. It was found that the three criteria and the number of pupils was manageable for an observing teacher to complete in a lesson. Due to the nature of the school (some pupils must walk long distances across the school to get to lessons) the pilot found that the first five minutes of the lesson should be omitted (as pupils arrive at staggered intervals throughout this period). The last five minutes of the fifty-minute lesson was also omitted; it was found that in this period most of the time is spent drawing the raffle and then packing away equipment.

Pupil Name	Time							
	14.10-14.15	14.15-14.20	14.20-14.25	14.25-14.30	14.30-14.35	14.35-14.40	14.40-14.45	14.45-14.50
Casper								
Patrick								
Luciano								
Jonny								
Cheryl								
Nadine								
Nicola								
Bradley								
David								
Simon								
Kimberley								

Code	Behaviour
1	Pupil being out of seat without permission
2	Pupil talking out loud without being called upon
3	Pupil lying on the desk

Figure 1: The tally chart used to observe pupil behaviour throughout each lesson. The lesson was divided into five-minute intervals and the times changed based on the period

Lesson reflections

After each lesson I wrote a reflection on the pupils' behaviours. The reflection was based on the questions suggested by Jones and Edwards (2017) and the reflection questions were:

1. What was the best thing (in relation to behaviour management) about the lesson?
2. How did the students react to the behaviour management system used in the lesson? Why?
3. What would I change about the behaviour management in the lesson if I were to do it again?
4. Was I happy with the amount of work that the students did in the lesson? Did the students reach the learning intentions for the lesson?

Additional desired datasets

The number of questions answered in each lesson was intended to be the primary indicator of positive behaviour. The initial intention was for pupil books to be analysed after the second lesson and returned in the next mathematics lesson. Pupil interviews were also going to be used to gauge the feeling towards the raffle tickets and how it affected pupil motivation and enjoyment in mathematics lessons. Unfortunately, due to the sudden school closure it was not possible to collect these additional datasets.

Limitations of the study

Unfortunately, due to the unexpected closure of the school, many of the initial data collection plans had to be changed. Several issues with obtaining the data have been outlined above. In addition, there were also several problems with the data collection methods used:

1. The two lessons were not performed on the same day of the week, in the same period or in the same room. The initial intention was to teach the first assessed lesson on a Wednesday (period six) and then teach the second assessed lesson during the same period on the following week. Due to the school closure this was not possible.
2. It was hoped that the study would be performed on a full class of approximately thirty pupils (the number of pupils who were present in both lessons was eleven).
3. The original methodology involved having the same teacher observe both lessons and tally the behaviour. Unfortunately, due to the circumstances the second lesson was observed by a different teacher. Although I briefed each teacher on the different behaviour criteria, it is possible that they will have each had different standards regarding what they consider negative behaviour for each criterion.
4. The lessons were taught in different rooms located on separate sites and each room had a different table layout. In the first lesson pupils were sat in what Chaplain (2017) refers to as a coffee bar layout (eight pupils sat directly opposite each other on large tables) and in the second lesson they were sat in a more traditional dyad classroom layout (pupils sat on rows facing the teacher instead of each other).
5. The second lesson (using raffle tickets) was taught on a day in which the pupils knew they were finishing school for an extended period.

6. The initial plan was to introduce the raffle tickets and use them in the subsequent five lessons (and monitor the behaviour in the fifth lesson). This would allow the pupils to become accustomed to the raffle tickets and give more time for positive behaviour routines to develop.

Ethical Considerations

All research was performed in-line with the current guidelines on educational research ethics published by the British Educational Research Association (2018). All pupil names and the school have been anonymised (any names that appear in this paper are pseudonyms). The research did not impact upon pupils teaching as the design of the raffle ticket system meant that the lesson was taught in the same way. The only difference was the reward of raffle tickets for displaying positive behaviours. Approximately two minutes of learning time (~4% of the lesson) was lost due to the explanation of the raffle ticket system and the prize draw. It was hypothesised that by promoting positive behaviours pupils would spend more time on task and this would account for the lost time. This is justifiable according to the current guidelines which state “at times, some benefits to participants may be compromised in order to achieve other gains or goals, but these compromises should be justifiable and, where possible, explicitly accounted for” (British Educational Research Association, 2018, p.8).

Research Outcomes

As discussed in the previous section, three different methods of data collection were used in this study. The results of each method will be systematically presented and discussed in terms of the project’s aim and Research Question, stated previously – how does the introduction of a lottery-based token reinforcement system impact upon:

1. The positive behaviour in a Year 7 mathematics lesson.
2. The negative behaviour in a Year 7 mathematics lesson.

Individual pupil motivation

The motivation of two individual pupils was assessed based upon the targets of their school behaviour reports (both pupils were set the same targets by their form teacher):

1. Stay focused throughout the lesson.
2. To complete all tasks to the best of my ability.
3. To put my hand up when I would like to talk.

The mark for both lessons for Luciano is shown in Figure 2 and for Jonny in Figure 3.

Lesson	Target Number			Teacher Comment
	1	2	3	
Without Raffle Tickets	3	3	2	Did not complete any work today.
With Raffle Tickets	1	1	1	Excellent work and effort.

Target 1- Stay focused throughout the lesson. Target 2- To complete all tasks to the best of my ability. Target 3- To put my hand up when I would like to talk.	<u>Grade</u> 1. Excellent 2. Good 3. Inadequate
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Figure 2: The results of Luciano’s behaviour report completed by myself at the end of each lesson

Lesson	Target Number			Teacher Comment
	1	2	3	
Without Raffle Tickets	3	2	3	Did not stay focused in lesson.
With Raffle Tickets	1	1	1	Excellent work and contributions.

Target 1- Stay focused throughout the lesson. Target 2- To complete all tasks to the best of my ability. Target 3- To put my hand up when I would like to talk.	<u>Grade</u> 1. Excellent 2. Good 3. Inadequate
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Figure 3: The results of Jonny’s behaviour report completed by myself at the end of each lesson

Figure 2 and Figure 3 show that in the lesson without raffle tickets the focus throughout the lesson was deemed to be inadequate for both pupils. For Jonny his teacher comment mentioned that he did not stay focused in this lesson. In the lesson in which raffle tickets were used both pupils were given the grade ‘excellent’ for their focus throughout the lesson. In relation to the research questions, an increase in focus is a direct indicator of pupil engagement in lessons. It is also hoped that a more focused pupil will exhibit less negative behaviours; although this may not always be the case (Greenwood, Horton & Utley, 2002). Both pupils also showed an increase in their ability to put their hands up when they wanted to talk, they were both graded higher for this target in the lesson which used the raffle tickets. This shows a reduction in negative behaviours (calling out) from these pupils in the raffle ticket lesson.

In the lesson with raffle tickets both pupils were scored excellent for their ability to complete all tasks to the best of their abilities (Figure 2 and Figure 3). The teacher comment mentioned that both pupils had performed ‘excellent work’ in the raffle ticket lesson. This was an improvement for both pupils when compared to the lesson without raffle tickets; especially for Luciano who was given an inadequate grade for his completion of tasks. The teacher also mentioned this in the comment stating that the pupil did not complete any work in the first lesson. This increase in task completion suggests that both pupils were more engaged in the second lesson.

Entire class negative behaviour

The number of negative behaviour incidents in the lesson without raffle tickets (Figure 4) and the lesson with raffle tickets (Figure 5) are shown below.

Pupil Name	Time							
	14.10-14.15	14.15-14.20	14.20-14.25	14.25-14.30	14.30-14.35	14.35-14.40	14.40-14.45	14.45-14.50
Casper								
Patrick								
Luciano			2		2 3	2	2 3	
Jonny			2		2	2		
Cheryl	2	2	2	2	2	2	2	
Nadine			2					
Nicola								
Bradley								
David			2					
Simon			2				2	
Kimberley			2		3			

Code	Behaviour
1	Pupil being out of seat without permission
2	Pupil talking out loud without being called upon
3	Pupil lying on the desk

Figure 4: The negative behaviour incidents recorded during a forty-minute period in the lesson without raffle tickets

Pupil Name	Time							
	10:50-10:55	10:55-11:00	11:00-11:05	11:05-11:10	11:10-11:15	11:15-11:20	11:20-11:25	11:25-11:30
Casper					2			2
Patrick	2				2		2	2
Luciano		3		2			2	2
Jonny						2	2	2
Cheryl				2	2			
Nadine	2							2
Nicola								2
Bradley				2				
David			2	2	2	2		
Simon				2				
Kimberley		2		2		2	2	

Code	Behaviour
1	Pupil being out of seat without permission
2	Pupil talking out loud without being called upon
3	Pupil lying on the desk

Figure 5: The negative behaviour incidents recorded during a forty-minute period in the lesson with raffle tickets

In order to compare the number of negative behaviour incidents across the two lessons, Figure 6 shows the total number of incidents (across the entire forty-minute period in each lesson). Each bar is divided into the number of code 2 and code 3 behaviour incidents (code meanings are shown in Figure 5); there were no code 1 behaviour issues recorded in either lesson.

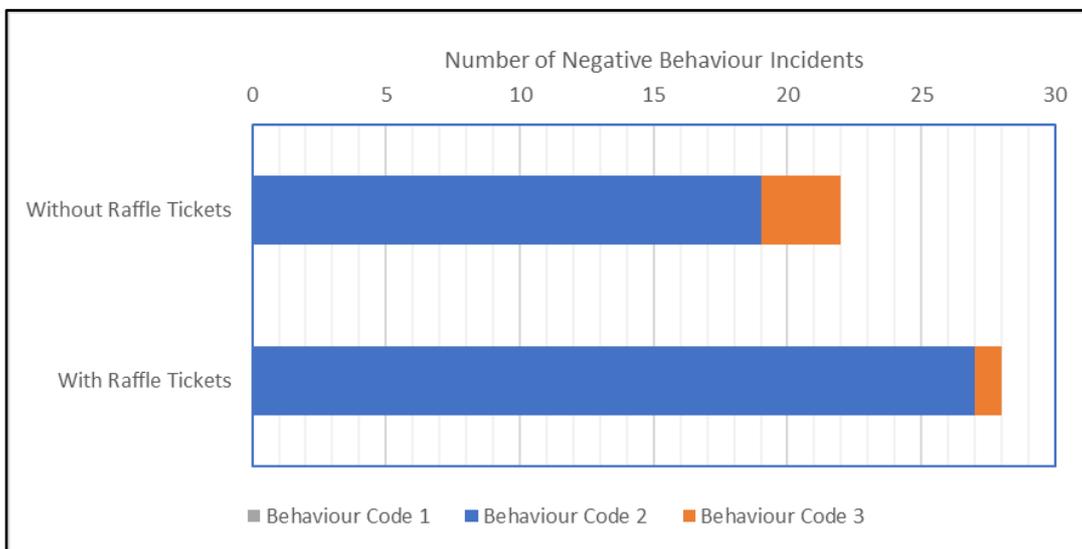


Figure 6: The total number of negative behaviour incidents recorded across the two lessons (without and with raffle tickets).

Figure 6 shows that the lesson in which raffle tickets were used led to an increase in negative behavioural incidents (potential reasons for this are discussed in the following section). In total six

more negative behavioural incidents were recorded in the raffle ticket lesson (an increase of ~27%) including an additional eight cases of pupils calling out in the lesson (an increase of ~42%). However, there were two fewer incidents of pupils lying on the desk, a direct indicator of pupil disengagement in the lesson. The results of the lesson suggest that:

- In the lesson with raffle tickets the pupils displayed more negative behaviours (significantly more calling out).
- It is possible that pupils were more engaged in the raffle ticket lesson based upon the slight decrease in the number of pupils lying on the desk (who were instead participating in learning).

Figure 7 compares the total incidents in each five-minute period between the two lessons. There is no clear relationship between the number of incidents and the lesson time intervals.

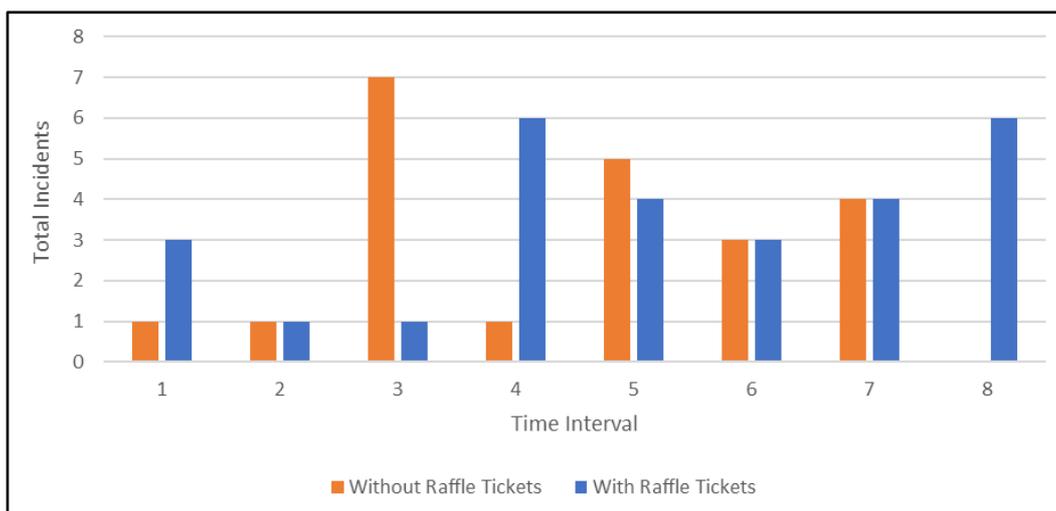


Figure 7: The total number of negative behaviour incidents recorded in each five-minute period across the two lessons (with and without raffle tickets)

The negative behaviours recorded for each pupil in each lesson are compared in Figure 8. In the lesson without raffle tickets seven pupils were responsible for all the behaviour incidents (four pupils had no negative behaviour incidents recorded). In the lesson which used the raffle tickets all pupils recorded at least one negative behaviour incident.

Figure 8 shows that the two pupils (Cheryl and Luciano) with the most negative behaviour incidents in the first lesson (without raffle tickets) saw a reduction in the number of incidents in the second

lesson (with raffle tickets). Seven pupils (~64% of the class) had an increase in incidents over the two lessons with four pupils who had no negative behaviour incidents in the first lesson all recording at least one incident in the second lesson (with raffle tickets). Cheryl had the biggest decrease in negative behavioural incidents (-5) and Patrick had the biggest increase (+4) over the two lessons. Figure 9 shows that the range of incident numbers per pupil were higher for the lesson without the raffle tickets (7) than the lesson with the raffle tickets (3). The interquartile range was the same for both lessons (3). The average number of incidents per pupil (indicated by an X on Figure 9) was similar in the lesson without (2) and with (~2.5) raffle tickets.

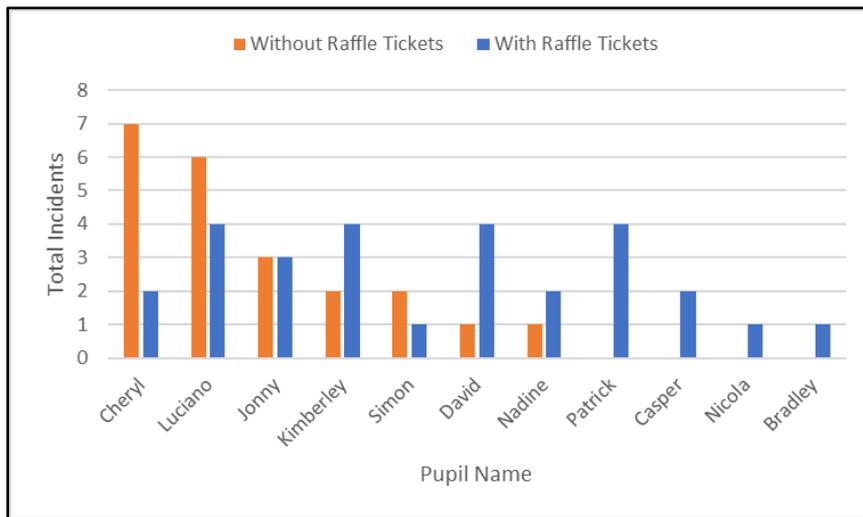
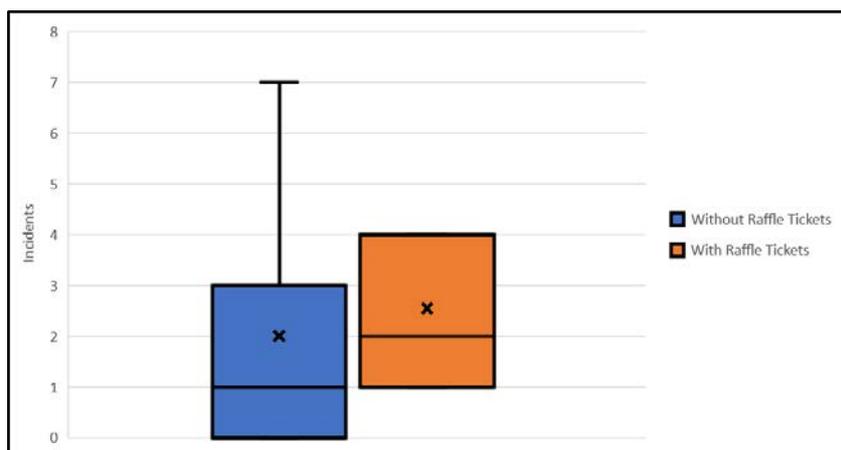


Figure 8: The total number of negative behaviour incidents recorded for each individual pupil across the two lessons (with and without raffle tickets)



x shows the average number of incidents per pupil for each lesson

Figure 9: Boxplot showing the total number of negative behaviour incidents recorded for each pupil across the two lessons (with and without raffle tickets)

Lesson reflections

Immediately after I had finished teaching each of the two lessons I wrote a lesson reflection. The reflections suggest that there was very little difference in negative behaviour between the two lessons. There were no major disruptions in either lesson and the only behaviour sanctions issued were rule reminders (the first step in the school's hierarchy of punishments) which have no further consequences. My lesson reflection does not suggest any significant difference in the negative behaviour of the entire class between the two lessons. The reflection that was written after the raffle ticket lesson suggests a possible explanation for the increase in negative behaviours observed: "It is very difficult to assign negative behaviours to factors other than the pupil excitement about the school closing that day".

My reflection suggests that pupils were more engaged in the lesson with the raffle tickets than in the lesson without them. In the lesson without the raffle tickets my reflection stated: "I was not happy with the overall amount of work completed by the class. Many pupils were off task and talking to each other about topics other than the questions". In stark contrast I was much more satisfied with the overall pupil engagement in the second lesson (with raffle tickets): "I was very happy with the overall amount of work completed by the class. All pupils were on task and working well (very little talking)".

One pupil, Luciano, was singled out in each reflection as he is currently on report and has been set the target of completing all work to the best of his ability. In the first lesson (without raffle tickets) I made the following comment regarding Luciano's engagement: "one pupil (Luciano) failed to answer a single question throughout the duration of the lesson (despite being an able mathematician who is capable of completing the work without any problems)". In the subsequent lesson (with raffle tickets) I comment on the work of Luciano and another pupil (who is also on report): "the two pupils on report (Luciano and Jonny) both worked well and were given an 'excellent' grade for their report target (to complete all tasks to the best of their ability)".

Summary

The introduction of raffle tickets did not lead to a reduction in negative behavioural incidents (there was a slight increase). There appeared to be a slight decrease in pupil disengagement (measured through pupils lying on the desk) in the raffle ticket lesson. In the first lesson (without raffle tickets)

a small number of pupils were responsible for the majority of the negative behaviour incidents; when raffle tickets were used in a lesson the incidents were more evenly spread across all pupils in the class. The two pupils who were monitored for their reports showed improvement in their engagement in the raffle ticket lesson. Both were graded 'excellent' for their ability to complete all tasks to the best of their ability, an improvement on the lesson without raffle tickets. Both pupils also received a higher grade (excellent) in the raffle ticket lesson for the target of putting their hand up when they want to talk compared to the lesson without raffle tickets. This suggests a reduction of negative behaviours in the raffle ticket lesson for the most behaviourally challenging pupils (i.e. those on report). My reflections written after each lesson suggest that overall, there was no significant difference in negative behaviours between the two lessons. There was an increase in pupil engagement in the raffle ticket lesson, from both the class as a whole and individual pupils (those on report). The teacher reflects that one pupil answered no questions in the first lesson but was deemed to have worked excellently in the lesson with raffle tickets.

Discussion

The introduction of raffle tickets had no overall effect on reducing the number of negative behavioural incidents in a lesson, however it led to an increase in positive behaviours (and a decrease in negative behaviours) of pupils who the school have identified as needing behavioural interventions. It should be stated that the study is severely limited due to the large number of variables across the two lessons. The following argument is based on the hypothetical situation that the introduction of the raffle ticket reward system was the only significant variable between the two lessons. The limitations of the study and other possible explanations for the results are also outlined in this section.

As discussed in the literature review, variations of token economies have been used for over 200 years as a behaviour management tool in schools (Kazdin, 1977). Therefore, extensive literature regarding their successful implementation exists (Boegli & Wasik, 1978; Crawford & McLaughlin, 1982; Filcheck et al., 2004; Flaman & McLaughlin, 1986; Mottram, Bray, Kehle, Broudy & Jenson, 2002; O'Leary & Drabman, 1971; Truchlicka, McLaughlin & Swain, 1998; Zlomke & Zlomke, 2003). The main difference between historical studies and this research is the method of token system implemented. Most systems require complicated economies with a variety of exchangeable rewards (of varying values and usually at significant expense to the school) and exchange periods;

this requires specialist staff training and whole-school implementation (Boegli & Wasik, 1978). The system used in this study requires very little training, costs very little money to implement (~£0.10 per lesson) and does not require school wide implementation.

Significance of research outcomes

As discussed previously behaviour management is a huge issue in teaching and “the impact of dealing with low level persistent disruption on a regular basis is one of the main reasons that teachers give for leaving the profession” (Williams, 2018, p.32). Therefore, practical methods that can be implemented by teachers to reduce the number of negative behaviours or promote positive behaviour amongst pupils are of huge importance and usefulness (especially to inexperienced teachers who have not yet developed successful strategies). The system is simple, incredibly cost effective, requires no specialist training and can be applied to any year group (in theory). Therefore, if it is shown to be effective it could be an incredibly useful strategy for both new teachers and experienced teachers who need to reduce negative behaviours and/or promote positive behaviours. A comparison between the two lessons shows that raffle tickets could potentially be a useful tool for promoting positive behaviours and reducing negative behaviours in more behaviourally challenging pupils. The introduction of raffle tickets led to an increase in the engagement of the class according to the reflections written after each lesson. They also had a significant positive impact upon the work completed by two of the more behaviourally challenging pupils in the class (Figure 2 and Figure 3). Figure 6 shows that the introduction of raffle tickets failed to reduce the total number of negative behaviour incidents across the two lessons (there was actually an increase).

Comparable studies

The rationale for this work was to examine a token system (purposely kept as simple as possible) and see how its implementation impacted upon the behaviour of a secondary school mathematics class. A previous review of token economies made two recommendations that influenced this work (Doll et al., 2013):

- Further research should be undertaken with older pupils (11-18 years old). This study was performed on secondary school pupils in Year 7 (11-12 years old).
- Teachers should be aware of a variety of token systems (e.g. response-cost, lottery systems, level systems, individual vs whole class) if they are to effectively implement a token

economy based upon the needs of the teacher and pupils. For example, many previous studies have focused on response cost systems (Kazdin, 1977; McLaughlin & Malaby, 1977; O’Leary & O’Leary, 1977) or class-wide reward systems (Bushell Jr., Wrobel & Michaelis, 1968; Packard, 1970). Very few studies have analysed the impact on behaviour (positive and negative) of a lottery token system. Therefore, due to the desire for teachers to be aware of a variety of token systems, this study focused on a system that has been studied much less frequently.

The motivation of the study was two-fold: to increase positive behaviours and to reduce negative behaviours in a Year 7 mathematics lesson. The outcomes of this study found that the addition of raffle tickets resulted in an overall increase in negative behaviours of the entire class. A large number of previous studies and reviews have all found the opposite to be true; that the implementation of a token economy results in a decrease in negative behaviours (Boegli & Wasik, 1978; Flaman & McLaughlin, 1986; Harden et al., 2003; Maggin et al., 2011; Mottram et al., 2002; Schwartz, 1989).

This work showed that the introduction of a token system (raffle tickets) led to a reduction in the negative behaviours of two pupils with problematic behaviour (as deemed by the school). Several previous studies have looked at the impact of various token systems upon individual pupils who are displaying behaviours which teachers typically struggle to manage (Higgins et al., 2001; Macdonald & Sherman, 1987; Zlomke & Zlomke, 2003). These studies found that the implementation of some variety of token economy significantly reduced negative behaviours in these pupils.

Although the introduction of the raffle tickets (a lottery token system) appeared to increase negative behaviours, it also led to an increase in positive behaviours. Previous studies of token economies have been shown to increase positive behaviours (Boegli & Wasik, 1978; Boniecki & Moore, 2003; McGinnis, Friman & Carlyon, 1999). A review of strategies for primary school pupils with behavioural difficulties found that token systems were shown to have a positive effect on time on task (the review looked at 28 previous studies) (Harden et al., 2003).

Why does the introduction of a token system improve pupil behaviour?

The raffle tickets used in this study are a secondary reinforcer which appeared to be valued by all the pupils in the class. The increase in positive behaviours following the introduction of the raffle

tickets can be explained by principles of operant conditioning (Kazdin, 1977). The raffle tickets may be effective positive reinforcers due to:

1. Being issued almost immediately after the positive behaviours were displayed; the effect of a reinforcer is maximised if delivered immediately (Kazdin, 1977; Kimble, 1961; Skinner, 1953).
2. There was no limit on the number of raffle tickets that pupils could earn; no limit was set as it has been shown that the greater the amount of a reinforcer the greater the frequency of the desired response (Kimble, 1961).
3. The more desired a reinforcer is the more impact it will have upon the desired behaviour. What may be an effective reinforcer for one pupil may be ineffective for another (Kazdin, 1977). It is incredibly difficult to measure the desirability of the raffle tickets; however, it should be noted that all pupils were excited at the prospect of earning these rewards and all eagerly took the tickets when issued them.

Alternative explanations for the research outcomes

The introduction of the raffle tickets appeared to have three effects on the behaviour in the second lesson. Alternative explanations for each of the three outcomes are discussed below.

An overall increase in negative behaviour

As discussed in this section, previous studies agree that the introduction of a token economy in a classroom setting typically reduces negative behaviours, but this was not the case in this study. There are several possible explanations for the increase in negative behaviour:

- The raffle ticket lesson was taught on the last day of school prior to an extended period of school closure (which the pupils were aware of). According to discussions with experienced teachers at the school, it is very difficult to engage pupils and manage behaviour on the last day before an extended absence.
- Two different teachers monitored the negative behaviour in each lesson. Despite my best efforts to explain what behaviours qualify for each code, it is possible that the teachers may have had different definitions of the three negative behaviour codes.
- The lessons were taught on different days and in different periods.

- It was not possible to teach the students a series of lessons in which they could become familiar with the raffle tickets and the positive behaviours required to earn them. In order to improve behaviour it is important to systematically teach all expectations (Chaplain, 2017; Colvin & Scott, 2014). This was not possible in a single lesson.
- The two lessons had the students sat in different seating plans (both in terms of who they were sat next to and the table configuration). It is unknown how both factors may have influenced pupil behaviour.

Increase in positive behaviour of two pupils who struggle to manage their behaviour

The use of raffle tickets appeared to reduce the negative behaviours of two pupils who the school had identified as having problematic behaviour in lessons. This agrees with the previous studies which found token economies to have positive effects on the behaviour of individual pupils (Higgins et al., 2001; Macdonald & Sherman, 1987; Zlomke & Zlomke, 2003). However, this increase in positive behaviour may be due to several other factors:

- The lesson was taught on different days and in different periods and it is not known what effect this may have had upon the behaviour of the pupils.
- The two lessons both used different seating plans and both pupils were sat in different seats and next to different pupils in the two lessons. The location of their seats relative to the teacher may have increased positive behaviours. It has been shown that pupils at the front receive more teacher attention (Good & Brophy, 2008); both pupils were sat nearer to the front in the raffle ticket lesson.
- In the first lesson the pupil desks were arranged in a coffee bar layout (eight pupils sat directly opposite each other on large tables) and in the second lesson they were sat in a more traditional dyad classroom layout (pupils sat on rows facing the teacher instead of each other). The coffee bar layout can lead to pupils being more easily distracted; particularly those with attention issues (like the two pupils analysed). The more traditional dyad layout is more effective for keeping pupil focus on the teacher (Chaplain, 2017).

Increase in positive behaviours of the class

Finally, the introduction of raffle tickets appeared to increase the positive behaviour of the entire class, this may be attributed to other factors:

- The dyad layout used in the second lesson is more effective for keeping pupil focus on the teacher (Chaplain, 2017).
- The lessons being taught on different days and in different periods may have resulted in an increase in positive behaviours in the second lesson.
- Although the lesson structure was initially kept as similar as possible in both lessons, the content taught in each lesson was different. It is not known whether a more engaging topic was taught in the lesson with raffle tickets. Engaging with an enjoyable topic or task can sustain positive behaviours for some pupils (Chaplain, 2017).

Areas for future research

The current study shows that the use of a raffle ticket-based lottery token system may have some potential to reduce negative behaviours in some pupils and increase positive behaviours of entire classes. Unfortunately, due to the school closure there were too many variables across the study, making it impossible to make any recommendations regarding the effectiveness of the raffle ticket behaviour management system. In order to validate the effectiveness of the raffle ticket lottery system as a behaviour management tool the study should be repeated. The issues with the study should be minimised (or removed) where possible.

Conclusion

Due to unforeseen circumstances (which resulted in the unplanned early closure of the school in which the research was taking place) the study was unable to yield any conclusions regarding the usefulness of a raffle ticket based lottery token system as a behaviour management strategy. Unfortunately, there were too many variables, in addition to the introduction of the raffle tickets, to attribute any behavioural changes to any one variable. However, the lesson in which the raffle tickets were introduced had several improvements when compared to the original lesson. The negative behaviour of two pupils (both of whom struggle to regulate their negative behaviours) decreased and the overall positive behaviour of the class (working well and being on task) increased

in the raffle ticket lesson. This provides the rationale for further studies into the use of raffle ticket-based lottery token economies. The system should be investigated further with additional classes and age groups. In future studies much greater care should be taken to limit the number of variables between lessons. If the method for introducing a raffle ticket-based lottery token economy can be shown to improve pupil behaviour in these future studies, it could become a very useful behaviour strategy for teachers to implement. The main benefits of the raffle ticket-based lottery token economy are:

- It is very simple to implement (requires no specialist training for staff).
- It can be used with individual classes and in specific lessons. It does not need to be implemented on a schoolwide level or used in every lesson.
- It is much more cost-effective than many other token economies. The only items that need to be purchased are the raffle tickets (~£1 per class per year) and a single prize for each lesson (~£0.10 per lesson). For a typical class (five mathematics lessons a week) this equates to an annual cost of less than £20 if a prize is given out in every lesson.

If the raffle ticket-based lottery token economy can be shown to be effective in future studies this could have a significant impact upon pupils' learning of mathematics. Reducing negative behaviours and promoting positive behaviours will positively impact upon mathematics lessons. Teachers will spend less time addressing negative behaviours; resulting in more lesson time that can be spent teaching mathematics and addressing pupil queries and misconceptions. Clearly, if positive behaviours can be encouraged in mathematics lessons (increased time on task, having appropriate mathematical discussions, etc.) this will have a positive impact upon pupil learning in these lessons.

A raffle ticket-based lottery token economy could potentially be a useful system for managing pupil behaviour. Unfortunately, due to the nature of the experimental method it is not possible to draw any conclusions or make any recommendations as a result of this work. In future studies it is vital to limit the number of variables in lessons; this will allow recommendations to be made based on the outcomes of these studies.

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