















students preferred the paper token delivery stating that such system allowed them to "...share it (paper tokens) with Friends [SIC] if you want to save up for something like Raptor room." Two students stated that they had equal preference for paper or iPad-based tokens.

Question two asked students to rate, on a scale of one to ten, how much they focused on obtaining tokens through being 'on task' during periods of using either of the two systems. Results indicated that 7 of 16 (43.8%) rated their attention to obtaining tokens as a 1 (did not focus on obtaining tokens at all). One student stated, "After a while, the thought of getting a reward wore down". Another three students (18.7%) gave the score of 3 and three more gave a score of 5. One of the students that indicated a 3 stated that they only focused on being on task to obtain tokens about a quarter of the time "...because your [SIC] so busy working." Two students indicated a 10 in response to question 2 and stated that they focused on receiving tokens "...all the time."

Asked in question three, which method (iPad, Physical, Both, None) they would recommend teachers use to help students focus on their work, one indicated paper, five indicated both and ten indicated iPad. One student that had indicated that they would recommend both systems to teachers stated that they did so "...cuz [SIC] then there would be two ways of getting rich!" One student that indicated they would recommend the iPad method stated they did so "...because it (tokens) can't be stolen." and "Because its [SIC] fun". It should be noted that early in the implementation, one instance of theft of physical tokens (bills) occurred (and was rectified by the teacher). This likely directly related to this student's reference to such possible issues on the anonymous survey.

The teacher participant also provided social validity feedback data through a separate questionnaire. Overall, the teacher participant indicated that the paper methodology was more effective in helping keep students on task. The teacher indicated that the paper method provided "...instant gratification... students knew why they earned the token... It caused a ripple effect around the student who earned the token, that others (would) see what happened and learn that if they did the same thing, they too could earn a token." As a corollary, the teacher stated that "...(using) the iPad system, students did not see when someone (else) earned a token because it only showed up on the individual who earned the (token on their) iPad." Further, the teacher noted the iPad app was difficult and time consuming to use.

## 5. Discussion

It is interesting to note that prior to the results of the present research being presented to the subject participants, the teacher indicated an overall satisfaction with the TE as a classroom management method. The teacher indicated that she felt the overall attention to task for students increased during times in which she implemented the TE methods. The results seemed to be surprising to the teacher when revealed at a classroom pizza party following the study.

### 5.1. Token delivery

A variable ratio schedule of reinforcement (token delivery) is generally accepted as effective regarding the tracking and reinforcement of on task behaviours [17, 18]. The teacher in the present study also requested this reinforcement schedule so that time to deliver tokens, both virtual and physical, could occur when breaks in her teaching flow allowed and so that instruction would not be interrupted based on a fixed interval reinforcement methodology. One possible explanation for the overall ineffectiveness of both token economy systems in the present study may be related to the variable ratio schedule of reinforcement. The reinforcement schedule that resulted from relying on breaks in lesson flow may have been sub-optimal for some students.

It is therefore possible that prior to the implementation of a variable ratio reinforcement schedule, students may require a more defined schedule of interval reinforcement prior to the application of a variable ratio methodology. Future researchers should consider this possibility as well as the equally possible reality that such alterations in delivery schedule may be impractical for a teacher to administer alone. Further study is required to address such hypothesis.

Another area of interest was the non-public nature of token delivery during the iPad based TE phases. It may be that when students noticed delivery of tokens, they made an effort to display the desired on-task behaviour but the behaviour might have dissipated when students noticed the teacher otherwise engaged. If this had been the case, we likely would have expected to see a difference in impact between the private iPad deliver and the public physical deliver of tokens. This was not the case in the present study.

Despite the teacher's best intentions, within the current study framework, she was unable to attend to the on-task behaviour of the group 100% of the time while teaching either group or station-based lessons. This would seem to indicate that the need to physically deliver tokens versus being able to do so from a distance did not impact the teacher's ability to attend



to the behaviours for which tokens were to be delivered. The teacher seemed to confirm this suspicion by stating in the follow-up questionnaire that "...allow(ing) the EA (educational assistant) to hand out the tokens instead of the teacher" for paper delivery would be helpful and simplifying the finding of specific students within the app's interphase would reduce the difficulty in delivering tokens to individuals and/or small groups of individuals. These assertions by the teacher seem to indicate difficulty with being able to teach while simultaneously attending to the observation of student on-task behaviours.

As with the previous assertion concerning public vs private token delivery, physically walking over to students (physical) vs taping an iPad (iPad) to deliver tokens did not seem to impact the effectiveness of either methodology as to impact on student on task behaviour. We would have expected to see a difference between the impact between physical and iPad-based methods if delivery method had been an important aspect of the method however this was not observed.

It is likely that the need to simultaneously focus on the fluid needs of instruction while teaching allows for limited attention to matters of observation regarding individual or group behaviours. Indeed, the teacher's token delivery occurred during times within lessons that did not require her direct involvement with a student. This hypothesis would seem to support recent research regarding a teacher's ability to multi-task. As cognitive tasks are divided between two or more pressing needs, the quality and efficiency of results is generally reduced [19, 20, 21]. Such a finding regarding teacher abilities to multi-task would seem to point to one possible reason for the overall failure of the TE system in the present study.

### 5.3. Token redemption

Token redemption took place at least one time per day at one or more pre-determined redemption periods, however the students were required to ask the teacher for redemption during the noted times. Sometimes the teacher was otherwise engaged during these times, speaking with other faculty members while children were at play or preparing stations for when children would return. Occasionally, the teacher was required to serve as a recess monitor and was unavailable to deliver tokens during recess. Overall, this resulted in a less predictable token redemption time period during both phases of TE implementation. Students may have been discouraged if they had intended on receiving a prize at a specific time period in which the teacher was unable to comply with a purchase request. While students had been told that not all the redemption periods would be available due to

the teacher's multiple commitments, and that one would be available at minimum per day, the lack of a solid, repetitive daily redemption schedule may have negatively impacted the students' motivation to remain on task.

Again, future researchers should address this redemption hypothesis in more detail to examine any impact a more predictable redemption schedule may have upon the overall time on task behaviours of students. Like the delivery hypothesis, researchers must also seek to understand if a predictable redemption schedule is reasonable to maintain when the teacher alone, implements the TE system. It may be the case that additional help may be required if predictable delivery of tokens and predictable redemption periods other than the one time per day in the present study are to be achieved.

### 5.4. Analysis of efficacy

Results indicated that the virtual delivery TE system and the combined data from virtual and physical methods were significantly effective over baseline (no TE) for Bob only. No other individual or whole group analysis showed a significant difference between base line and the two TE approaches nor between the two TE approaches themselves. This may indicate that in spite of statistical indications, the delivery of tokens to Bob was optimal or effective by sheer chance alone (within the 5% error range). Also, Bob's data included an outlier in data point five (score of 0). No obvious reason for Bob's inattention during that data observation period was noted and thus for official analysis, the point remained within the data set. It is important to note, however, that this possible outlier influenced the magnitude of significant results. Adding visual assessment of raw data, it seems that at best, we can describe the results for Bob as inconclusive.

While the current findings indicated support for the findings of Maggan et al., and Ivy et al., [12, 2], the current work would seem to contradict some other available research regarding the effectiveness of TE systems within an inclusive classroom setting. Given the negative results of the present work in relation to previous studies suggest that clarity in the implementation of studied TEs is critical to understanding conclusions drawn from any findings. In the present work, implementation fidelity was strictly noted and adhered to a pre-defined set of standards. Given those standards, results showed the method as implemented not to be an effective support regarding on task behaviours within the student population studied. When one considers the incredible differences with which the idea of a TE can be implemented (ie: multiple human intervention agents,

the behaviour/s of focus, the diversity of students individual characteristics, the token delivery and redemption schedules), it is likely not possible to assert that any 'generic' TE method should be the focus for analysis leading to the categorization of evidence based practice. Instead, specific versions of the TE, strictly defined, may be a more proper unit of analysis.

## 6. Limitations

This work is limited to that observed within the contexts of the participants within the location chosen for the study. Results should not be used to justify broader meaning outside of this context, as individual circumstances exist in any defined population and context of study.

Additionally, time on task represents a difficult variable of measure. Specifically, data collectors were required to identify the direction of each subject's attention or activity toward a direction, activity or object that was relevant to the instruction being provided at that time while simultaneously excluding indicators of non-attention to task as defined by Lee, Sugai and Horner [15]. The relevance of the direction of attention or activity based on instruction can be somewhat subjective to the person judging the data point. For example, if a student is looking at his/her shoes while the teacher is working mathematics on a white board, the data recorder would likely mark the data point as 'not on task' however if the teacher were using eyelets of shoes as an example to count pairs of objects, the same gaze would be recorded as 'on task'. IRR was used to indicate the breadth of subjectivity with reasonable findings however it is important to acknowledge such as a limitation to the results of the present work.

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## 8. References

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