Apply Interdependent Group Bonus Rewards

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A Brief Review

Independent versus interdependent Rewards

Table 1. *Independent versus Interdependent Group-Oriented Contingencies*

Contingency	Target Student(s)	Target Behavior	Criteria	Consequence
Independent Group-oriented Reward	*All* first-grade students in Mrs. Smith's class	Math Assignment 10 single digit addition problems	Each student in the class who scores 90% correct on the assignment	Each student who meet criteria receives a Letter grade of A and a sticker
Interdependent Group-oriented Reward	*All* first-grade students in Mrs. Smith's class	Math Assignment 10 single digit addition problems	Class average of 90% correct on the math assignment 10	All students in the class get 5 min of bonus recess

With **independent group-oriented bonus** rewards, the same reward is delivered to each student contingent upon their own performance on that same task (e.g., assignment, exam) meeting the same criterion (e.g., 90%). Unfortunately, some students stop putting forth academic effort, which is required to learn, because they rarely earn rewards because for these students the criteria is too high and/or the task is too difficult.

1. One solution is to set individual contingencies (i.e., individual target behaviors, rewards, criteria). Individualized or personalized systems of instruction can be effective – BUT THEY ARE VERY HARD TO IMPLEMENT.
2. Another solution is to set lower independent criteria or assign easier work. Lowering expectations for everyone or watering down the curricula is likely to have an adverse effect on some students. MOST TEACHERS DO NOT WANT TO DO THIS.

With **interdependent group-oriented bonus rewards,** all or none in the group earn the same reward based on the group meeting some group-oriented criterion (e.g., class average). Supplementing independent contingencies with interdependent group-oriented bonus rewards can cause low performing students to put forth effort because now their effort may be rewarded. In fact, because low performing students can improve the most, they often have the biggest impact on the group's improvement. Additionally, high performing students are encouraged to continue to do their best and often perform better, even though they have little room to improve. Because students' fates are intertwined (interdependent) these contingencies can cause students to encourage, prompt, teach, and praise one another. While we offer a reward, there is another incentive built in, the group winning and the social reinforcement that follows. Have you ever been part of a winning team?

A GUIDE OR TIP SHEET FOR APPLYING INTERDEPENDENT GROUP ORIENTED CONTINGENCIES

I – UNFAIRNESS AND BONUS REWARDS

One of the limitations of interdependent bonus rewards is that they are unfair. A student can do very well and not earn a reward because his classmates did poorly. Also, a student can do poorly and earn a reward because his classmates did well. These problems can be addressed by:

1. **Avoiding high stakes rewards, including grades and punishment.**
   Rationale:
   - I have colleagues who think giving group grades is a good thing. I do not. How would you respond to a student or a student's parents who complain that their child could not go to the college of their choice because they got a poor grade in your class, which was caused by her group members doing poorly on a group assignment?
   - Do not use interdependent group punishment. Punishment almost always involves consequences that students consider high-stakes. Do our laws allow us to punish someone for someone else's behavior?

2. **Introducing contingency as a chance to earn bonus rewards.**
   Rationale:
   - I taught students with EBD. They complained that it was not fair when they did well but did not earn a bonus reward. I responded by:
     a. Offering to stop giving them an opportunity to earn bonus rewards.
     b. Reminding them of other rewards (independent and individual) and other reasons for doing well (e.g., math will help with career).

II - SELECTING REWARDS

All or none get the same reward. Consequences (rewards and punishers) are idiosyncratic and may not be stable within the same student. The same consequence may be a high quality reward for John, a low quality reward for Jane, and a punisher for Jill. Challenge - consequences should be rewards to all or almost all, but punishing to none. If it is punishing to some, then those students may be reinforced (escape avoidance) by doing poorly and sabotaging classmates efforts. **Example – opportunity to play dodge ball.**

When selecting rewards, remember David Premak who encouraged us to think about rewards as opportunities to engage in preferred behaviors.

1. **Reinforcing for everyone- examples:** extra free time, recess time, computer time. These allow students to choose to engage in preferred behaviors (some shoot hoops, others lean on the fence chatting).

2. **Scarcity breeds demand:** Grundyism, or adherence to convention, is your enemy when selecting bonus rewards. Scarcity breeds demand. Perhaps bonus rewards

should not be available for other behaviors, otherwise they do seem like bonus rewards.

Examples of bonus rewards include: extra recess at old overgrown playground, a piece of candy or gum, being able to listen to music during independent seat work, shooting waste paper baskets, pushing teacher around the room while seated in a chair, teacher sings students a song, teacher dressing like Pippy Longstockings, principal taped to the wall, students singing a song. Tangibles and consumables (e.g., pencils, other school supplies, cheap plastic toys that break easy, candy). Best if these thing break easily or are collectable (different colored mechanical pencils), that way after they acquire some, students will want more.

3. **Avoid activities that are incompatible with school work:** listening to music, chewing gum, eating candy, or wearing a hat do not interfere with doing school work. Extra recess, free time, computer time, or watching a fun movie can interfere with school work.

   I have always liked music, have come to appreciate edibles.

4. **Randomly Select Rewards from a Pool:** developing a pool of rewards and randomly selecting one can solve many problems. As long as there are a few high quality rewards for each student in the pool, all students may be highly motivated. Additionally, can include many rewards that are compatible with school work (listening to music), while also including others that are incompatible (extra recess).

   Developing a Pool of Reward: Student Advice Teacher Consent

   a. Have a suggestion box (show box, use index cards)
   b. Teach guidelines - free or very inexpensive, take little or no time away from teaching and learning, liked by all students, does not violate school rules or laws.
   c. Teacher reviews suggestions after school, ignore inappropriate ones and never let them know you read them, announce appropriate ones the next day and see if students like them – then add to pool.

III. SETTING CRITERIA

We do not have a science that allows us to set a goldilocks criterion (i.e., not so low that you do not get their best performance and not so high that they give up).

1. Reinforce improvement – this is ok until the scores are so high that they give up.
2. Set low and gradually increase (shaping) – this is ok because they often earn the reward early (priming the pump) which can make program more powerful. Unfortunately, we do not know how much to re-set criteria.
3. Randomly select – unknown, thus only know they have to do their best, thus may be maximum performance their first day (see Popkin and Skinner graphs). Can prime the pump by rigging the system so they earn the first day or two. Next, alter the pool of

randomly selected criteria so there are more slips of paper with more stringent criteria as they improve.

IV. TARGET BEHAVIORS

Interdependent group bonus rewards have been used to increase on-task, assignment completion, and prosocial behaviors. They have also been delivered contingent upon low levels of off-task or inappropriate/disruptive behaviors.

Public versus Private: Students may blame or aggress against classmates that they perceive as causing them to fail to earn rewards. Thus, public disruptive behaviors are problematic. Because they are disruptive so they catch classmates' attention, which can increase the probability of blaming and aggressing.

Academic Performance: Students are not supposed to be told how classmates did on assignments or exams (art is still the exception). Thus, it may be less likely to occasion these side effects. Percent correct, while considering incomplete items incorrect, may be strongest. Get completion and accuracy.

On-task: This may be appropriate for teacher led instruction. However, because off-task is often observable, care must be taken to avoid blaming. For example, you can randomly select a row and observe at randomly select times. Thus, the group does not know who caused the class to fail to earn.

V. MAINENANCE EFFECTS:

We are using **indiscriminable contingencies** – because they never know how well their classmates are doing, no student knows how well they have to do to earn a reward – thus, they do their best. These bonus rewards are even more indiscriminable when randomly selecting rewards, criteria, target behaviors. This should enhance maintenance.
The randomly selected reward may be X, thus I need to do my best.

Fading – could fade rewards, but another method of fading is to get more behavior for same reward (more effort for same reward). Love adding target behaviors (Popkin & Skinner) or enhancing criteria by altering the randomly selected criteria.

VI. NEGATIVE SIDE EFFECTS

Fairness (students) – bonus reward, remind of other rewards, offer to stop.

Fairness (teachers) – some teachers will resist giving a reward to a student who did poorly or just behaved atrociously. Remind them that they must deliver to all or none or they will lose students' trust.

More grading and responding to students' questions: now they are now trying harder, especially poor performers who may need help. Prepare for this with assistant teachers, peer help – but remember to train helpers so that they do not give students answers.

Cheating – we found one example of a student giving a tablemate an answer in Scott et al. Be on the look-out for this.

Blaming – as long as students do not know how classmates are doing, this should be kept to a minimum. Private behaviors can prevent this. Independent seat work is often private.

Over-justification, reducing intrinsic motivation, or ruining kids with rewards –
Mixed results on studies. Early studies suggested it was likely to be caused by tangibles, now they say by laddered reward (e.g., 80% gets you 1 candy, 90% gets you 2 candy). Found no evidence of it with Scott et al. Note, we are doing the opposite of a known laddered system.

Multiple Parents Called Teacher to See if Child Fudged Report Card -
The Popkin and Skinner bonus reward program was so effective that students report cards looked fishy to parents, thus they called the teacher to check.

Interdependent Group Bonus Rewards to Enhance Academic Performance in Math

ENHANCING MATH PERFORMANCE

Many different curricula, programs, or approaches to teaching mathematics have been promoted (e.g., new math, touch math, math manipulatives). Most these pedagogical methods require extensive training and teachers to alter almost everything about their current instructional practices. Numerous applied researchers have shown that wholesale change in math education may not be necessary, as merely supplementing their typical classroom procedures (TCP) with interdependent group-oriented bonus rewards, can cause immediate, consistent, and meaningful increases in students' math performance.

Table 1 (see page 1) describes two types of group-oriented contingencies. Independent group-oriented contingencies are in place where each student gets access to the same reward contingent upon their own performance and contingency components are the same for everyone in the class (see table 1). Predictably, some students cease to put forth effort because they rarely or never earn the independent rewards, which requires all students to meet the same performance criteria.

With interdependent group-oriented bonus rewards, all or no students receive access to a bonus reward when some aspect of the group's (e.g., class) performance exceeds a criterion. Thus, even low performers are motivated to put forth their best effort because they can earn rewards. Table 2 (see page 6) summarizes the results of 6 studies which showed class average performance increases when interdependent group-oriented bonus rewards are applied. In several of the studies researchers provided data on individual students which showed that these contingencies tend to cause very large increases in the lowest performing students (e.g., Scott et al., found that failing first-grade students enhance their performance by 48%), while still

increasing the performance of students scoring above 89% during TCP, despite the fact that ceiling effects suggest that they have little room to improve. *We are working on a meta-analysis of these and other results.*

Relevance or significance: Unlike other strategies, these procedures do not require educators to alter their current instructional methods, instead they are supplemental and designed to be applied with current procedures. As these procedures are supplemental, they require additional resources (e.g., time and effort). This analysis suggests that the extra resources required are worth the effort.

1. These contingencies work for all students and cause immediate, consistent, and meaningful changes (e.g., over 40% improvement in percent correct on math assignments) in low performing students who may have given up as early as first grade.
2. Applying these bonus rewards enhances rewards delivered in school and for math effort, which is likely to occasion many positive side effects.
3. In these studies, we found no evidence of over-justification effects.
4. Procedures that include randomly selecting criteria, rewards, and target students (e.g., a randomly selected table) can all enhance the ability to install and maintain these procedures across classrooms and perhaps reduce the probability of over-justification effects.

Note: I currently have a paper under review that I cannot distribute (copyright laws) that specifically targets mathematics academic performance. Also, I have submitted a grant proposal to extend this research. Below is a table summarizing the key studies. Thus, I provide an annotated bibliography of each study.

Table 2. Summary of studies.

Study	Class	Assignments	Criterion	Rewards	DVs	TCP	BGR	Gain
Winett, 1975	6th gr GE	In-class, low, med, high	Fix – 90% complete	Extra recess	% comp % corr	54% 40%	92% 67%	38% 27%
Popkin 2003	EBD mid sch	In class, individual	R - % corr Ave.	R- token, games, etc.	% corr	67%	87%	20%
Scott 2017	1st gr GE	In-class	R - % corr Class/table	R - edibles	% corr	63% 63%	83% 84%	20% 21%
Zibreg 2016	8th gr 17 – 10 Sped	Homework	R- % corr % comp	R – party toys, party, pencils	% comp % corr	61% 51%	94% 88%	33% 37%
Little 2010	4th grade	Homework	Beat previous	Free time	% comp % corr	73% 65%	89% 81%	16% 16%
Aloisio 2006	4th grade	Homework	R – ave, lows etc.	R – compu. time etc.	% comp % corr	89% 68%	94% 79%	5% 11%

Annotated Bibliography In Class Math Performance

1. Winett, R. A., Battersby, C. D., & Edwards, S. M. (1975). The effects of architectural change, individualized instruction, and group contingencies on the academic performance and social behavior of sixth graders. *Journal of School Psychology, 13*, 28–40. https://doi.org/10.1016/0022-4405(75)90034-5

Extra recess was provided when a 6th grade general education class completed 90% (class average) of its independent seatwork. Assignment completion increased 38%, from 54% to 92%. Accuracy increased 27%, from 40% to 67%.

- *Criteria and R+ were fixed,*
- *Assignment completion, not accuracy, was rewarded. Accuracy still unacceptable at 76%.*
- *Study confounded by dividing into groups (high, med, low) at the same time they ran the interdependent bonus reward intervention.*

2. Scott, K. C., Skinner, C. H., Moore, T. C., McCurdy, M., Ciancio, D., & Cihak, D. (Oct, 2017). Evaluating and comparing the effects of group contingencies on mathematics accuracy in a first-grade classroom: Class average criteria versus unknown small-group average criteria. *School Psychology Review, 46,* 262–271.

All first grade students (16 in the class) were provided a randomly selected edible reward contingent upon their percent correct on independent seatwork. There were two interventions, one where a table was randomly selected and that table's average had to beat a randomly selected criteria. The other was class average. Both caused almost identical increases in class average from 63% to 83 or 84%.

- *randomly selected rewards, criteria, and target students (in "table" condition)*
- *showed you can randomly select a subgroup of students and it be as effective as using the class average. Much easier to score and provide immediate R+.*
- *suggest that targeting % correct may be better than % complete (see Winett). In this study, incomplete problems were scored as incorrect.*
- *showed large increases in failing students (below 60%) - had an average increase of 48%*
- *all students making A (above 89%) also increased, even though they had little room to improve.*

3. Popkin, J., & Skinner, C. H. (2003). Enhancing academic performance in a classroom serving students with serious emotional disturbance: Interdependent group contingencies with randomly selected components. *School Psychology Review, 32*, 271-284.

In this study, 5 middle school students (a class in self-contained school) with EBD received a randomly selected bonus reward if their average performance (independent seat work, tests, each student had different assignments) exceeded a randomly selected criterion. First, it targeted spelling. After a while, math was added and students did not know which would be randomly selected. Finally, language arts was added. Thus, at the end, students did not know which academic performance would be targeted, or the criteria or reward.

- *Randomly selected rewards, criteria, target behaviors (incremental addition)*
- *It targeted middle school students with EBD*
- *Some students had second grade curricula while others had seventh. No one complained that a classmate's assignments were easier than theirs because it*

benefited the students with 7th grade work when classmate excelled on their second grade level work.

- *Teacher thought the work was too hard*
- *Randomly selected academic assignments. At the end of study, students did not know what they had to do well at (spelling, math, or language arts), but doing well at all increased the probability that they would earn a reward (fading by increasing demands).*
- *Increases were meaningful.*
- *Fading by keeping R+ steady but increasing demands.*
- *Negative side effects – more requests for help from teacher, more teacher grading time*
- *Parent phone calls wondering if their child fudged report card.*

Annotated Bibliography Math Homework Performance

4. Aloisio, D. B. (2006). *Improving homework completion and accuracy: Interdependent group contingencies with randomly selected components* (Psy.D.). Hofstra University, United States -- New York. Retrieved from https://search.proquest.com/pqdtglobal/docview/305318936/abstract/87B2BDD683A5441EPQ/2

This study targeted homework in 4th grade students. Increases in completion and accuracy were 5% and 11%, but the students were doing pretty well already. The randomly selected criteria were not just averages, but included things like,' all exceed a particular minimum.' Also, like Popkin, the target behaviors were randomly selected (completion v accuracy, completion and accuracy.

- *Randomly selected rewards, criteria*
- *I am concerned that the students may have been confused when a complex array of criteria was applied all at once. Remember, Popkin first starting by targeting just spelling. Also, Popkin worked with EBD students who often understand and undermine contingencies better than general ed students.*
- *They were doing pretty well before intervention (during TCP), thus less room to improve.*

5. Little, S. G., Akin-Little, A., & Newman-Eig, L. M. (2010). Effects on homework completion and accuracy of varied and constant reinforcement within an interdependent group contingency system. *Journal of Applied School Psychology*, *26*, 115–131. https://doi.org/10.1080/15377900903471989

This study also targeted % correct and percent completion and both had to beat their previous score for the group to earn extra or bonus free time. Thus, criteria and rewards where both known (like Winett).

- *Known rewards, known criteria*
- *Hard to beat pervious criteria, eventually criteria would get really high*

6. Zibreg Hargis, D., Patti, A. L., Maheady, L., Budin, S., & Rafferty, L. (2016). Using

interdependent group contingencies with randomly selected criteria and rewards to enhance homework performance in an eighth-grade classroom. *Journal of Evidence-Based Practices for Schools, 15*(2), *172-192.*

The 8th grade class included 17 students, 10 receiving special education services. Math homework was targeted and rewards were randomly selected and included parties, toys, pencils,…

Provided bonus rewards if the class average met randomly select criteria. 5 criteria on slips of paper focused on percent of students who completed homework (i.e., two slips had 80%, two had 90% and one had 100%). The other 5 criteria slips focused on class average accuracy (80%, 85%, 90%, 95, and 100%)– how to win accuracy at least 70% had to complete. Class average percent correct increased from 51% to 88%.

- *Randomly selected rewards, criteria, target behaviors (completion v completion and accuracy)*
- *Like Popkin, large average increases*
- *Like Scott, improvement across students (7% to 53%).*
- *8 students with disabilities increased an average of 44% (28% to 53%).*

Summing up – seemed to work better for in-class work, percent correct (with incomplete scored as incorrect, and more unknown randomly select seemed better.

ENHANCING ON-TASK DURING MATHEMATICS CLASS

One common problem faced by teachers is getting students to attend or engage. Researchers have shown how interdependent group-oriented contingencies can be used to enhance engagement during math class. Litow and Pumroy (1975) differentiated between individual and group contingencies and described different types of group-oriented contingencies. With interdependent group-oriented contingencies, all members of a group (e.g., a class) receive access to the same consequence contingent upon some aspect of the groups' behavior. Because each student's access to the consequence is contingent upon their own behavior and the behavior of others in the group, these contingencies are considered interdependent. Interdependent group-oriented rewards can be used to supplement most typical classroom procedures so that all or no students receive access to a bonus reward when some aspect of the class' math performance (e.g. on-task behavior) exceeds a criterion.

We reviewed studies that examined the effectiveness of implementing interdependent group-oriented contingencies to increase on-task behaviors in math class. Two studies used similar methodology by having a clock run continuously when all students in the class were engaged in on-task behaviors (Andrews & Williams, 1971; Greenwood, Hops, Delquadri & Guild, 1974). When any student displayed off-task behavior, the clock was stopped and either a light was turned off or a buzzer was sounded until all students returned to on-task behaviors. Students were told that the class would earn free time equal to the amount of time (i.e., number of seconds) all were engaged in task-relevant activities (e.g., on-task). Both studies revealed immediate increases in on-task behaviors when the interdependent group-oriented contingency was applied. Andrews and Williams (1970) found that a class of nine junior high school student enrolled in a remedial summer school class (all were 2 years or more behind in math) enhanced

their on task behavior from 67% to 90% after the bonus reward program was added. Greenwood et al. (1974) found similar effects across three general education elementary classrooms (1st, 2nd, and 3rd grade).

Heering and Wilder (2006) also applied an interdependent group-oriented contingency to enhance on-task behavior in a third- and fourth-grade math class with 31 and 33 students respectively. They constructed their contingency to address several concerns, or negative side effects, associated with interdependent group-oriented contingencies. They randomly selected a row of students that would be observed at four different moments (10-14 min apart). At these moments, the assistant teacher observed the designated row and recorded whether all students were on-task with a yes or a no. If all students were scored on-task for three of the four moments in the 50 min class, each class member earned a reward. The students did not know what row was being observed or when it was observed. Additionally, students were not given feedback until the end of the class period. Finally, the rewards were also unknown. When the class met the criteria, the reward was randomly selected from a pool of rewards. Across both classes, after the contingencies were applied, on-task levels immediately increased from below 50% to above 80%.

Relevance/Significance: Teachers may ask, "*How can I get students to learn if I cannot get them to attend to directions or instructions?"* The studies reviewed suggest that adding group oriented bonus rewards can be effective. However, when one compares methods used by Heering and Wilder (2006) with the other two studies, it become clear that their procedures have more contextual validity because they are easier to install and maintain and may occasion fewer negative side effects. A brief explanation is provided below.

1. Heering and Wilder's momentary time sample at 4 separate instances requires much less time than the continuous monitoring procedures used by other researchers which required educators to constantly stop and start clocks. Thus, because their procedures require less teacher time, it is easier to install and maintain and may be less likely to disrupt teaching and learning activities (Scott et al., 2017; Skinner & Watson, 2000).
2. With Heering and Wilder's procedures, because students do not know when they will be observed and which row will be scored, it is difficult for students to determine which classmate(s) caused them to fail to earn a reward. The lights or buzzers used by the other researchers are likely to signal students to observe classmates and determine whose behavior is causing them to fail to earn additional free time. Thus, these cues may increase off-task behavior and the probability of students blaming or aggressing against classmates (Skinner, Skinner, & Burton, 2009).
3. Heering and Wilder's use of randomly selected rewards may enhance the strength of the rewards (Murphy, Theodore, Aloisio, Alric-Edwards, & Hughes, 2007).
4. Both Andrews and Williams (1971) and Greenwood et al. (1974) had a clock running continuously, when a student became off-task it stop and either a light went on or a buzzer went off. Thus, all students were likely to look up to determine whose behavior was likely to cause them to be losing extra free time. Thus, these procedures may be more likely to occasion classmates to blame or aggress against peers.

ACADEMIC INTERVENTIONS

General Papers

1. Skinner, C. H., Cashwell, C. S., & Dunn, M. S. (1996). Independent and interdependent group contingencies: Smoothing the rough waters. *Special Services in the Schools, 12*, 61-78.

Applied analysis (strengths, weakness, and recommendations) of interdependent group contingencies. This paper also provides an example of the misuse of interdependent group contingencies.

2. Skinner, C. H., Skinner, A. L., & Sterling, H. E. (2002). Best practices in utilizing group contingencies for intervention and prevention. In A. Thomas & J. Grimes (Eds.), *Best practices in school psychology - 4th ed.* (pp. 817-830). Washington DC: NASP.

This book chapter provides a summary of how and why to randomize group contingency components.

Academic Interventions General

3. Skinner, C. H., Skinner, C. H., & **Burton, B.** (2009). Applying group-oriented contingencies in classrooms. Akin-Little, K. A., Little, S. G., Bray, M., & Kehle, T. (Eds.) *Behavioral interventions in schools: Evidence-based positive strategies* (pp. 157-170). Washington, D.C.: APA Press.

This chapter covers general issues and applied recommendation for applying interdependent bonus rewards to enhance academic performance.

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