Application of a Token Economy in Teaching Piano Technique

by

Tracey Ralene Teresa Picone
B.A., University of Victoria, 1993

A Thesis Submitted in Partial Fulfillment of the
Requirements for the Degree of

MASTER OF ARTS

in the Department of Psychology

We accept this thesis as conforming
to the required standard

[redacted]

Dr. L.E. Acker, Supervisor (Department of Psychology)

[redacted]

Dr. B.C. Goldwater, Departmental Member (Department of Psychology)

[redacted]

Dr. J. Backus, Outside Member (School of Music)

[redacted]

Dr. L. Dyson, External Examiner (Department of Education)

University of Victoria

Supervisor: Dr. L.E. Acker

ABSTRACT

Five piano students were taught technique, as outlined by the Toronto Conservatory of Music. The efficacy of a traditional use of stickers was compared to the use of shaping procedures employing tokens with multiple baseline and reversal control conditions. Measurements included the amount of weekly improvement as measured by percentage of available points (or potential points for baseline) earned, number of exercises completed each week and average number of weeks needed to demonstrate mastery of assignments. All students showed improvements in all measurements during treatment conditions, and declines in performance accompanied return to baseline conditions. Implications for further uses of token economies in the field of music instruction are discussed.

Examiners: [redacted]

Dr. L.E. Acker, Supervisor (Department of Psychology)

[redacted]

Dr. B.C. Goldwater, Departmental Member (Department of Psychology)

[redacted]

Dr. J. Backus, Outside Member (School of Music)

[redacted]

Dr. L. Dyson, External Examiner (Department of Education)

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Acknowledgment

A very special thank-you to Sandra Acker, for all her help in researching this topic.

Most people take piano lessons for fun, to learn how to play songs they are familiar with. It comes as no surprise, then, that students are not exactly fond of the mundane technical drills that are required to truly learn the art of playing piano. Such drills are rarely received with praise or even acknowledgment from family and friends when performed; nobody has ever gone to a recital or concert to hear a great musician perform technical drills. Music in the form of songs is what is reinforced in our society. For some students, this just means they avoid the technical drills as much as possible, and only learn what is truly necessary to progress in song acquisition (i.e. only what they encounter within the pieces they are playing). However, for students who follow a formal program and take exams, technique itself is examined and, therefore, unavoidable.

Generally teachers consequate completion of an exercise or assignment with verbal praise and stickers when progress has been shown. For technical drills, the use of a sticker, even if it is a reinforcer, may come too far removed from the learning of even the first steps that are the basis of the drill. Also, for some students, collecting only stickers may not result in an increase in the likelihood of them practicing the skills involved in learning technical drills. These "non-effects" of the presumed reinforcers can be seen when students fail to learn what they are assigned in a timely manner, having to be reassigned exercises repeatedly, and resulting in the teacher having to nag the student and even resort to threats and punishment (such as calling the parent). It would appear that the key to improving the learning of technical drills is to find reinforcers for any and all learning involved in the mastery of the assignments. This may also mean finding a way to vary reinforcers across time, as what is reinforcing at one point for any one person may not be reinforcing at other times, even for that same person (Martin & Pear, 1988).

Token Economies

Reinforcement theory states that any behavior that is consequated with a reinforcing change in the environment will increase in strength, and that the more immediate the reinforcer the greater the effect. Token economies are systems designed to create a motivating environment which take full advantages of this reinforcement theory (Ayllon & Azrin, 1968). Conditioned reinforcers, such as poker chips or money, are paired with a variety of backup reinforcers, such as desired objects or activities. In the token economy, desired behaviors are rewarded with tokens *immediately*, which the client can later trade for the desired backup reinforcer. This system has many benefits. Firstly, the token can bridge the gap between the occurrence of the desired behavior and the receipt of the reinforcer in cases where it is not possible to produce the reinforcer immediately (e.g. giving a child an ice-cream cone in the middle of a piano lesson). Secondly, the teacher can ensure that every student receives a reinforcer specific to them, as there can be a wide variety of backup reinforcers to suit every individual involved (one must remember that what is reinforcing to one individual may not be reinforcing to another). Also, the teacher can vary the number of tokens earned for each activity performed. By doing so, less frequent, desirable behaviors (e.g. doing homework, cleaning up room, practicing piano scales) can earn the student more tokens than more frequent, less desirable behaviors. Overall, the token economy allows the teacher to set up a situation where maximal reinforcement is available to the students, and a system that can be both standardized and specialized for the needs of the individuals involved.

Token economies have been used in a wide variety of settings, to teach everything from social skills and work habits to improved self care (Atthowe & Krasner, 1968). Initial settings were often chronic psychiatric wards, where "traditional" treatments failed to improve the behavior of the patients (Ayllon & Azrin, 1968). When it was established that such systems did have the desired effects, token economies were adapted into educational settings. Often, these systems were used to decrease disruptive behavior, but over time they came to be used to help increase the reinforcement of the small steps required in learning. Gaynor (1975) emphasized that, although teachers realize the importance of the small increments of knowledge needed to amass greater amounts of knowledge, often the students have little realization that this is how they will gain greater control over their environments. He stated, "In general, the real world pays for adult competence, not for the schoolboy's successive approximations to it" (Gaynor, 1975, p. 273-274). By using a token economy the teacher can reinforce even the smallest of increments in learning and help "pay" for student's approximations to adult competence.

Token Economies in Music

When token economies were used in educational settings, they were not restricted solely to the traditional classroom; they were used in any setting where skills were to be taught, including music education. Again, these applications have tended to focus on increasing behaviors that support or make possible the actual skills to be learned. For example, Salzberg and Greenwald (1977) used a token economy to increase attentiveness and punctuality in group string-instrument classes. Their criteria for earning tokens were any behaviors that contributed to the learning of their instrument, such as practicing and

not disrupting the class. It was found that when the token economy was in effect, both practicing and punctuality increased.

Whereas most token economies are used in group situations, Smith and Singh (1984) used a self-administered token system to increase technique practice activities, specifically scale playing, chord playing, and song playing. Although the authors reported immediate and substantial improvements through the use of the token economy, this study left many important issues unaddressed. For example, the focus was on quantity rather than quality of practice time. This would be acceptable if sheer time produced skill mastery, but this is not necessarily the case - quantity of practice time does not ensure quality, and mere repetition without due care can even be detrimental if the student is practicing incorrectly. Also, it is questionable whether only the token economy was in effect; the subject was also an author, so to not practice would be undermining his study, bringing aversive contingencies into effect, most likely strengthening his practicing behavior through avoidance. They go on to explain that as the behavioral requirements increased (i.e. more behaviors needed to be performed to earn a token) the number of practice sessions decreased from six per week to only one per week. This would suggest that the experimenter/subject was in fact not receiving adequate reinforcement and that avoidance behavior, in the form of not practicing, implies playing was in fact becoming aversive. All in all, although this study does show some support for the use of token economies in music, it does not allow one to draw clear conclusions as to their effectiveness. All the more unfortunate is the fact that little else has been done to

assess the usefulness of token economies for teaching the skills needed in learning to play a musical instrument.

The Present Application of a Token Economy in Teaching Piano Technique

It can be seen that token economies are effective in increasing desired behavior by improving reinforcement contingencies. If it is a lack of proper reinforcement contingencies that is largely responsible for lack of improvement in piano technique learning, it would follow that by implementing a token economy, the piano teacher could be more effective in facilitating technique learning. This is what the present study set out to examine.

As has already been mentioned, piano teachers generally consequate completion of an exercise or assignment with verbal praise and stickers when progress has been shown. For song learning, being able to hear what you play as a tune, or play for friends and family who may praise your efforts, may also serve to reinforce the practicing, learning, and volunteering to play. This was shown by Smith and Singh (1984) who found that, after applying a token economy, returns to the baseline condition caused a decrease in technique playing, but no decrease in song playing. For technical drills such as scales and triads, there may be little such inherent reinforcement, because these exercises are not generally associated with social reinforcement, such as people recognizing tunes or even singing along. Also, due to the difficulty often associated with learning drills, the award of a sticker, even if it is a strong reinforcer, may come too far removed from the learning of even the first basic steps that are the basis of the drill. By using a simple token

economy, the drills can be broken down into more manageable steps, and reinforcement given more immediately for each successive approximation of the target behavior. For example, if a student cannot complete a scale both ascending and descending, the teacher could break it down into ascending (giving reinforcement for improvement there) and then descending (giving reinforcement for this separately). In this way, the student always receives reinforcement for at least some aspect of performance, allowing the teacher to use the performance as a step in the shaping process.

Another benefit of a token program is that the teacher can focus on the troublesome aspects more carefully. If a student can play all the right notes, yet does not receive reinforcement because incorrect fingering was used, then even the learning of the proper notes goes unrewarded. However, the teacher could break down the exercise, allotting some immediate giving of points for correct notes and more points for fingering, allowing the note learning to be reinforced independent of fingering. From this point, the teacher could break down the fingering, perhaps giving points for each correct finger used, and then later for every two correct fingers, and so on, again shaping the behavior and allowing for constant contingent reinforcement. If the student should need physical or verbal prompting to correct something such as fingering, the teacher could provide the prompt, and then provide reinforcement when the behavior occurs. Later, the cue could be faded out, and reinforcement continued to strengthen the behavior until it is mastered.

By reinforcing even the most basic of steps in the learning process, the teacher can ensure the student will master all required elements. In doing so, later exercises should

be easier, as the elements remain constant across keys. This would also mean that later exercises should be reinforced by ease of learning, keeping the entire experience a positive one. All too often students "hate" technique; in most cases this may mean it has become aversive due to the amount of effort required to learn and complete the exercises, and they receive too little reinforcement for performing such behaviors. If one can ensure generous reinforcement, the exercises should not become aversive, making the learning experience easier and more pleasant for both student and teacher alike.

Another benefit of using a token economy would be the lack of satiation. For some students, collecting only stickers may not be reinforcing enough for them to practice the skills involved in technical drills. Often, piano must compete with activities such as sports, games and TV. With a token economy, points are earned towards a variety of items, thus taking advantage of various states of deprivation and other setting events which may change what a student finds reinforcing at any particular time. This helps give drills a "fighting chance" against other desired activities. Also, with a token economy the teacher can vary the points earned according to the student's likelihood of practicing, as well as the student's learning history, giving points more frequently for smaller, manageable steps of improvement or more frequently when more frequent criticisms are needed as well.

By using a token economy, a teacher not only helps the student master the required skills, but also helps ensure the learning process is generally full of reinforcing consequences even though critical feed back may occur, too. Suzuki, world renowned violin teacher, once stated that there is no poor student, only poor reinforcement

techniques, as "it is the teacher's responsibility to motivate his students sufficiently that he will never be able to find an excuse ("This child does not practice") for a poor student" (Starr, 1976, p.17). Therefore, the student who fails to improve does so due to lack of proper reinforcement and careful shaping and fading on the part of the teacher. This study was aimed at improving student performance through the use of a token economy which would increase the reinforcement available, and would help the teacher implement shaping and fading techniques.

Method

Subjects

Subjects were five students between the ages of 10 and 14 years who were taking private piano lessons. All subjects followed the graded system laid out by the Toronto Royal Conservatory of Music which prescribes technique to be mastered for examination purposes. Subjects had been in piano lessons for three to six years prior to this study.

Method

Each student's goal was to meet the technical requirements for his/her grade as outline by the Toronto Royal Conservatory. The teacher assigned several technical exercises each week, on which the child would be tested at the next lesson. If a student demonstrated mastery of the exercise, s/he was consequated according to the experimental condition. During the baseline condition, this would entail the traditional award of a sticker on the student's chart as the children were previously accustomed to. During the treatment condition, the students received points marked in the back of their notebook as well as the sticker on the technique chart. When mastery was demonstrated

and consequated appropriately, a new exercise was assigned in its place. If mastery was not demonstrated, the exercise was reassigned. No penalties were imposed for lack of mastery.

When an exercise was not mastered, and hence was reassigned, the student was verbally praised for their effort and asked to try the exercise again. This time, under treatment conditions only, the teacher would stop the student just before he/she reached the spot where they had made the mistake the first time, and would give a discretionary point for progress made thus far. At this point the teacher would correct the student's previous mistake and have the student make the correction, immediately reinforcing the student with another discretionary point for demonstrating the corrected element of the drill. All cases of progress were reinforced with verbal praise, and at no point were the number of corrections greater than the number of positive statements made or discretionary points awarded. The positive to corrective statement ratio did not differ between conditions; during baseline conditions, the same procedure to correct mistakes was used, only the positive statements were not accompanied by the points.

This study used a single-subject, multiple baseline design with an added reversal. The number of weeks for baseline and treatment conditions varied for each subject (Table 1). The reasons for this were more practical than experimental; students taking exams did not change condition assignment just prior to, or just after, their exams as it would not have been possible to separate the effects of the exam from the effects of the token economy. Also, given that two pairs of students are siblings, when one sibling was earning points (treatment), the other would not be, so that there was no concurrent

Table 1

Relative condition assignments for students.

	Student A	Student B	Student C	Student D	Student E
1	BASELINE				
2	BASELINE				
3	BASELINE				
4	BASELINE				
5	BASELINE				
6	TREATMENT				
7	TREATMENT				
8	TREATMENT				
9	TREATMENT				
10	BASELINE				
11	BASELINE				
12	BASELINE				
13	BASELINE				
14	BASELINE				
15	BASELINE				
16	BASELINE				
17	BASELINE				
18	BASELINE				
19	BASELINE				
20	BASELINE				
21	BASELINE				
22	BASELINE				
23	BASELINE				
24	BASELINE				
25	BASELINE				
26	BASELINE				
27	BASELINE				
28	BASELINE				
29	BASELINE				
30	BASELINE				
31	BASELINE				
32	BASELINE				

	Student A	Student B	Student C	Student D	Student E
33	TREATMENT	BASELINE	BASELINE	BASELINE	BASELINE
34	TREATMENT	BASELINE	BASELINE	BASELINE	BASELINE
35	TREATMENT	BASELINE	BASELINE	BASELINE	BASELINE
36	TREATMENT	BASELINE	BASELINE	BASELINE	BASELINE
37	TREATMENT	BASELINE	BASELINE	BASELINE	BASELINE
38	BASELINE	BASELINE	BASELINE	BASELINE	BASELINE
39	BASELINE	BASELINE	BASELINE	BASELINE	TREATMENT
40	BASELINE	BASELINE	BASELINE	BASELINE	TREATMENT
41	BASELINE	TREATMENT	BASELINE	TREATMENT	TREATMENT
42	BASELINE	TREATMENT	BASELINE	TREATMENT	TREATMENT
43	BASELINE	TREATMENT	BASELINE	TREATMENT	TREATMENT
44	BASELINE	TREATMENT	BASELINE	TREATMENT	TREATMENT
45	BASELINE	TREATMENT	TREATMENT	BASELINE	TREATMENT
46	BASELINE	TREATMENT	TREATMENT	BASELINE	TREATMENT
47	TREATMENT	TREATMENT	TREATMENT	BASELINE	BASELINE
48	TREATMENT	TREATMENT	TREATMENT	BASELINE	BASELINE
49		TREATMENT	TREATMENT	BASELINE	BASELINE
50			TREATMENT	BASELINE	BASELINE
51			BASELINE	BASELINE	BASELINE
52			BASELINE	BASELINE	BASELINE
53			BASELINE	BASELINE	BASELINE
54			BASELINE	TREATMENT	BASELINE
55				TREATMENT	BASELINE
56				TREATMENT	BASELINE
57					TREATMENT
58					TREATMENT
59					TREATMENT
60					TREATMENT
61					TREATMENT

competition for points and/or prizes. This was done because it would be impossible to determine the effects of such a confound, and a confound would interfere with interpretation of data produced within the token economy condition. On baseline days, students received a sticker for each mastered drill. On treatment days, students received points in accordance with the "technique points chart" (Table 2), as well as the sticker on their chart for the mastered drill. The available "prizes", with their individual "points price tag" attached, were visible for students to look at before their lesson. When the student had acquired the number of points needed for the prize of their choice they were allowed, by interrupting the lesson, to immediately exchange their points for that prize. At the first lesson of the treatment condition, several prizes available for few points (i.e. one or two) were available, and the teacher ensured the student had enough points to buy one of these prizes. At this time the student was encouraged to buy the prize, in an effort to establish the value of the points (Martin & Pear, 1988). If none of the prizes appeared reinforcing to the student (as was the case twice), the teacher asked the student what s/he desired, such as a piece of music the teacher could copy or even a one week break from technique, at the teacher's discretion. Students most often had a particular prize they expressed an interest in working towards.

At the beginning of each lesson, the teacher asked the student what s/he wanted to start with (i.e. technique or songs), and their response was recorded in an attempt to measure the desirability of technique playing. Also, during the lesson time, two opportunities for the students to "spontaneously" play piano were given during breaks where the teacher was writing information in the student's notebook. This was a second way to determine

Table 2

Maximum available points for mastery of technical exercises

Exercise	*Available Points*
old major scale	1 point
old minor harmonic scale	1 point
old minor melodic scale	1 point
old broken triad	1 point
old solid triad	1 point
new major scale	3 points
new minor harmonic scale	3 points
new broken triad	3 points
new solid triad	3 points
new cadence	3 points
new contrary motion scale	3 points
new minor melodic scale	4 points
new arpeggio	4 points
old formula pattern scale	5 points
new formula pattern scale	10 points

whether technique playing was reinforcing enough for the student to chose to play it over songs.

Inter-observer Reliability

A recorded tape was made for each student comprised of six matched samples of different exercises (two examples of the same exercise, one which had been passed and one which had been reassigned), and eight single samples of different exercises, half of which had been passed and half of which had been reassigned. Blind observers listened to the tape, and indicated which samples they felt had been mastered (passed) and which had not been mastered (reassigned). This was done to try and establish that the teacher/experimenter's criteria for passing and/or failing technique was socially valid (Martin & Pear, 1988).

Results

Number of Exercises Completed

As shown in Figures 1 through 5, all students showed an increase in the percentage of assigned exercises mastered during treatment condition compared to baseline conditions. The occasional positive acceleration of curves for the week before treatment condition contingencies were applied is an artifact not caused by the token economy. Rather, the teacher wished not to reward poor performance with the opportunity to switch to the token condition, and so changed students' conditions only if they had performed at over 80% that week. There were, however, times when the teacher did not impose this criterion, such as when the student had an impending exam and, hence, it was more desirable for the student's sake to be taught using the token system.

Figure Caption

Figure 1. Student A - Percentage of assigned exercises completed per week.

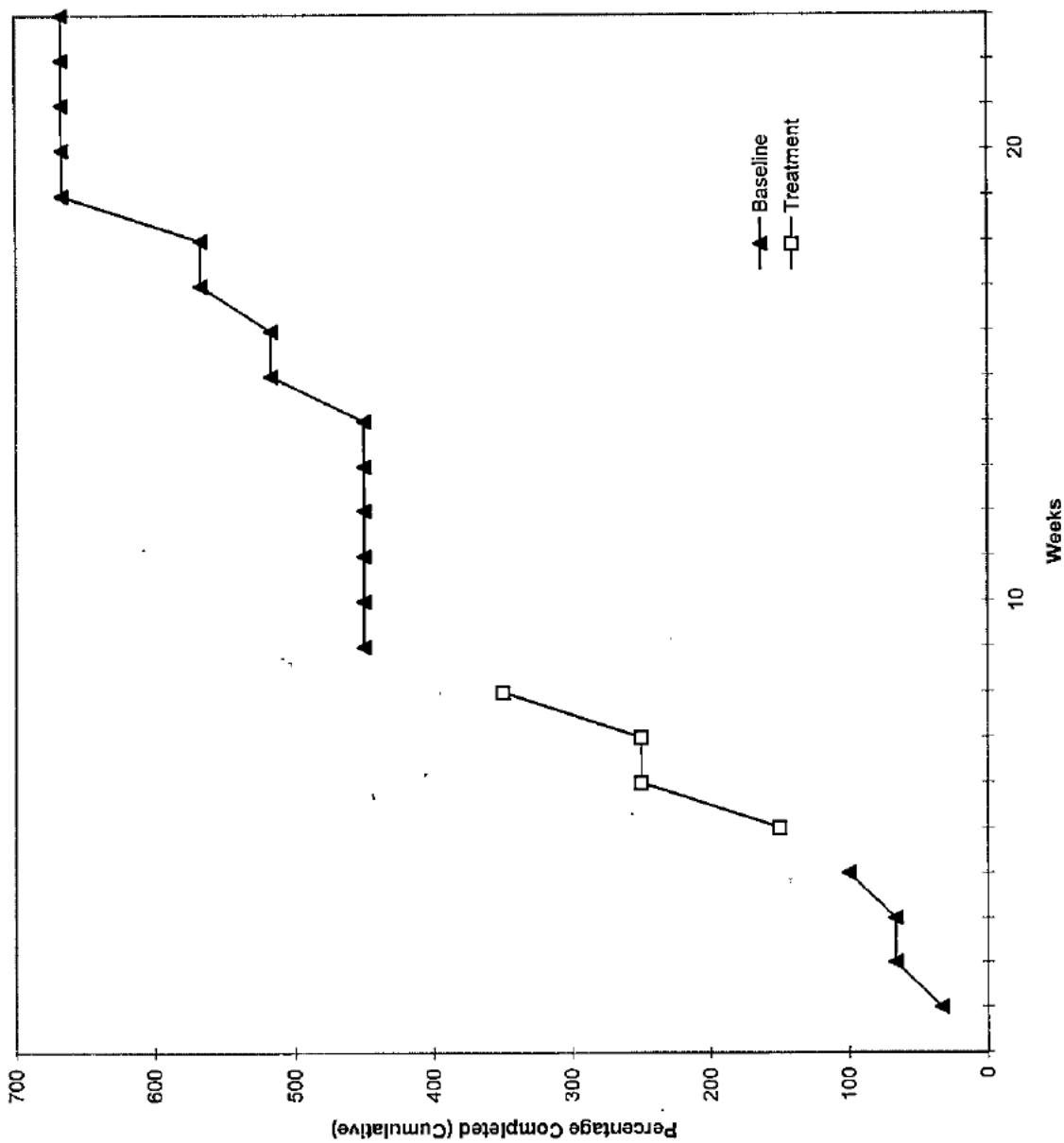

Percentage Completed (Cumulative)
0
100
200
300
400
500
600
700
Weeks
10
20
Baseline
Treatment

Figure Caption

Figure 1. (continued) Student A - Percentage of assigned exercises completed per week.

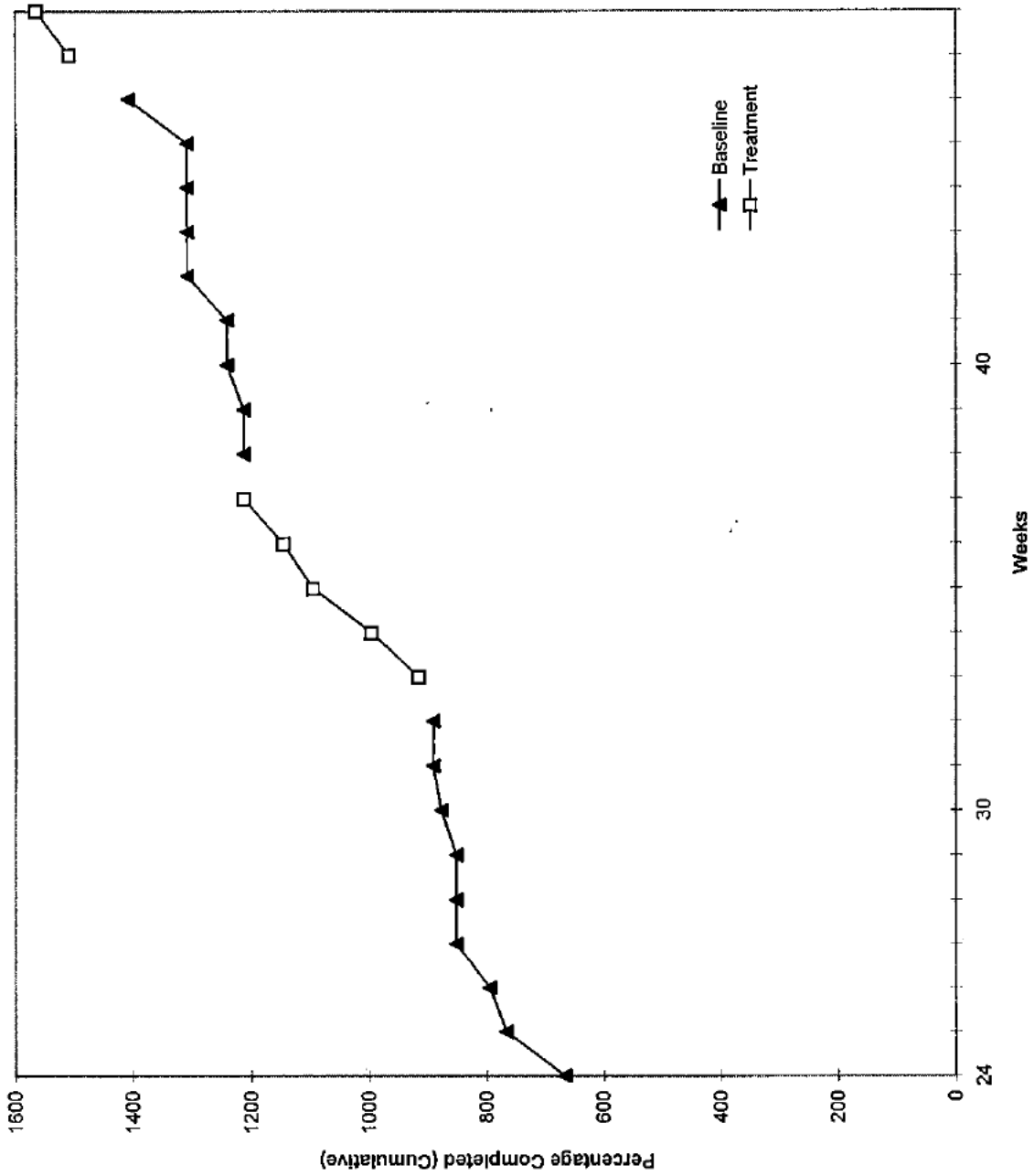

Percentage Completed (Cumulative)
1600
1400
1200
1000
800
600
400
200
0
24
30
40
Weeks
Baseline
Treatment

Figure Caption

Figure 2. Student B - Percentage of assigned exercises completed per week.

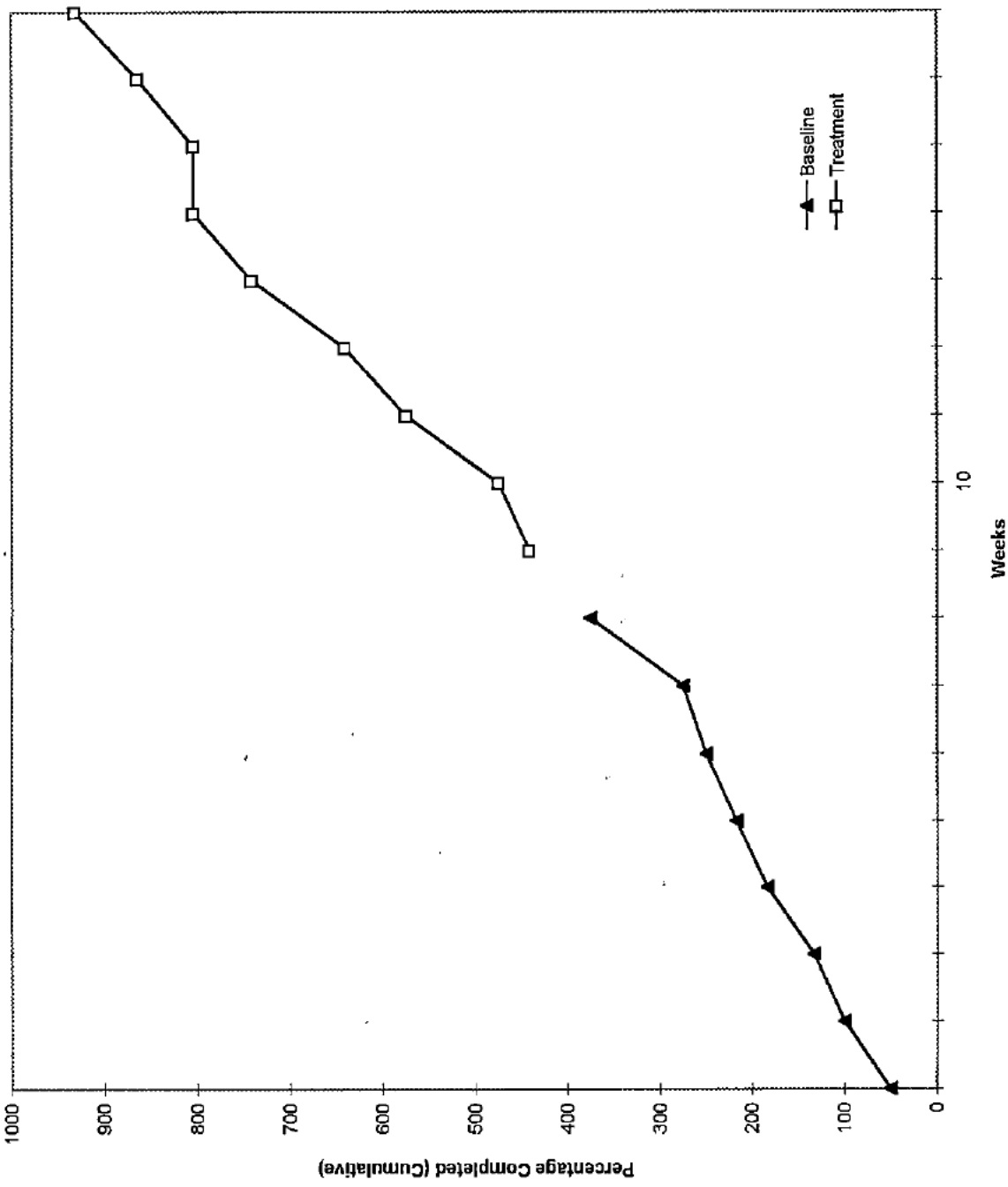

Percentage Completed (Cumulative)
1000
900
800
700
600
500
400
300
200
100
0
Weeks
10
Baseline
Treatment

Figure Caption

Figure 3. Student C - Percentage of assigned exercises completed per week.

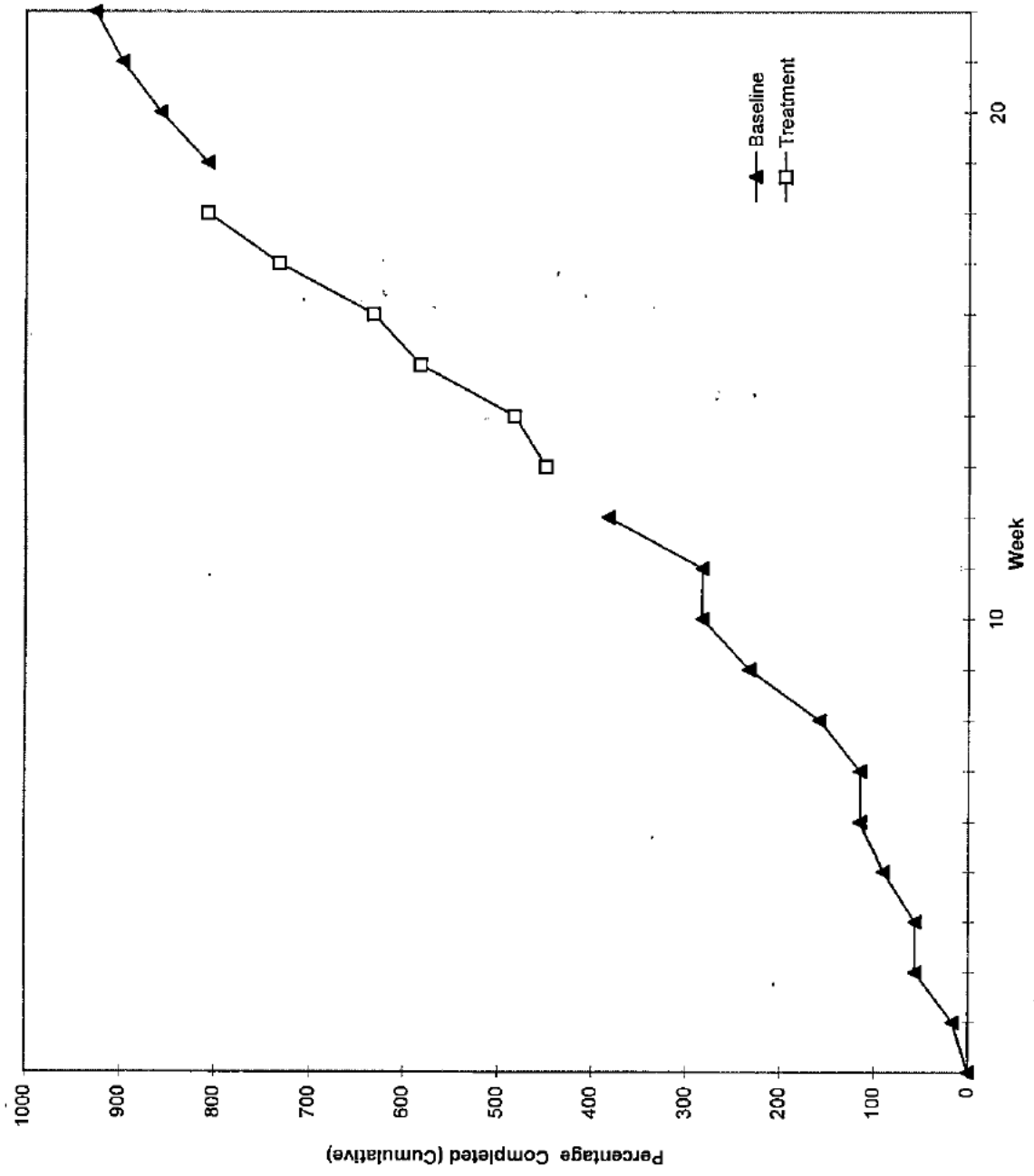

Percentage Completed (Cumulative)
1000
900
800
700
600
500
400
300
200
100
0
10
20
Week
Baseline
Treatment

Figure Caption

Figure 4. Student D - Percentage of assigned exercises completed per week.

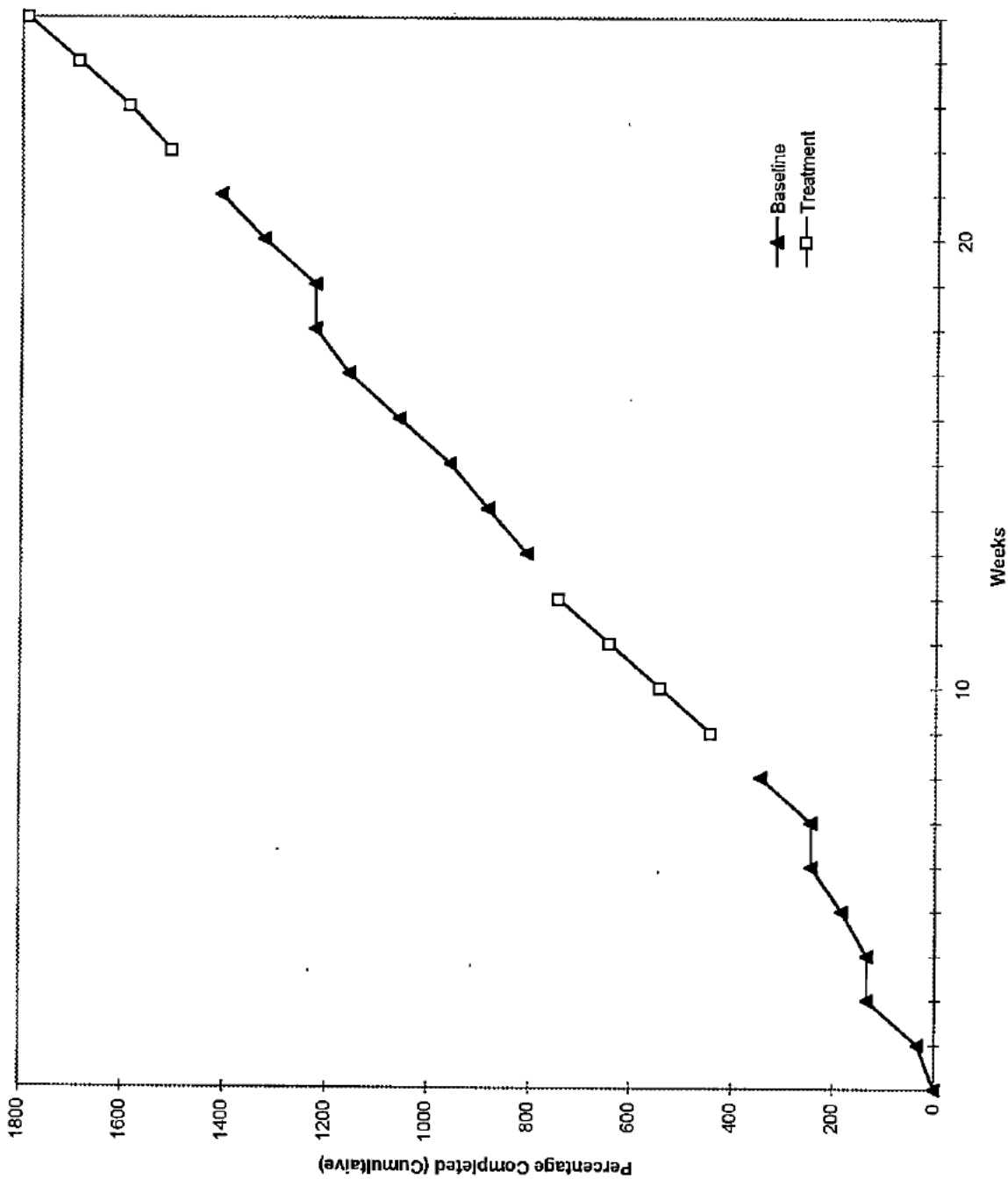
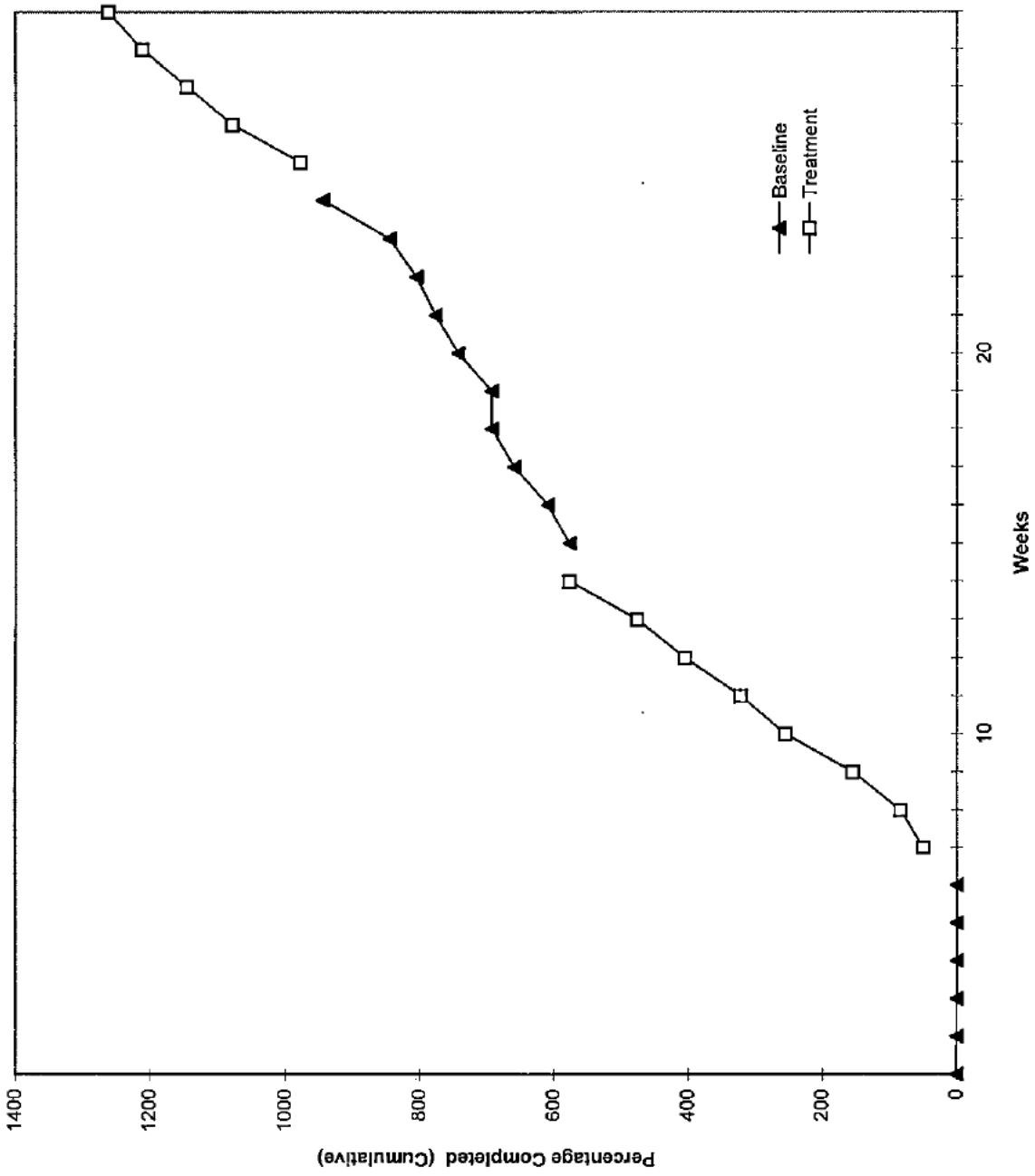

Percentage Completed (Cumultaive)
1800
1600
1400
1200
1000
800
600
400
200
0
Weeks
10
20
Baseline
Treatment

Figure Caption

Figure 5. Student E - Percentage of assigned exercises completed per week.


Percentage Completed (Cumulative)
1400
1200
1000
800
600
400
200
0
Weeks
0
10
20
Baseline
Treatment

Frequency of "spontaneous" playing of exercises

Students performed unassigned exercises, in addition to assigned exercises, only during treatment conditions. The frequency of this was as follows: Student A, once; Student B, three times; Student C, twice; Student D, twice; and Student E, once. At these time, students performed one or two unassigned exercises after having demonstrated mastery of all assigned exercises.

Number of points earned

As seen in Figures 6 through 10, all students showed an increase in the percentage of points earned per lesson during treatment conditions compared to baseline conditions. This shows that students were not simply mastering the easier exercises more during treatment conditions, as this would have resulted in a lower number of points being earned in the treatment condition due to the easier exercises' lower points values. Rather, students were mastering exercises of varying difficulties equally reliably during both treatment and baseline conditions.

Number of weeks taken to master exercises

Figure 11 shows the average number of weeks it took students to demonstrate mastery of an exercise within each condition. All students showed a decrease in the number of weeks the exercises needed to be reassigned when tokens were given contingent on performance. Again, only during treatment conditions were students observed to perform unassigned exercises, which resulted in several exercises being learned in "zero" weeks. The frequency of this was as follows: Student A, one exercise;.

Figure Caption

Figure 6. Student A - Percentage of available points earned per week.

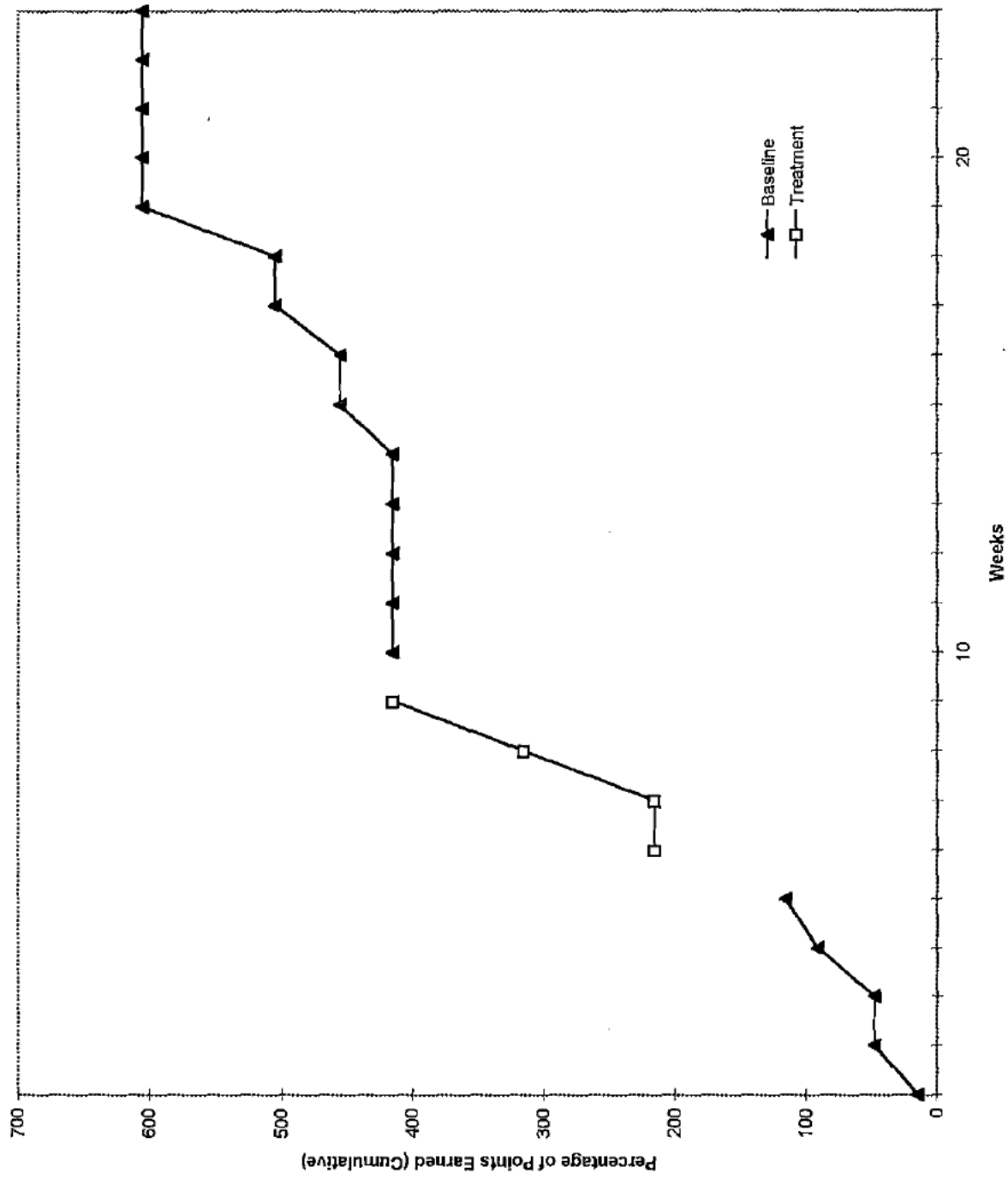

Percentage of Points Earned (Cumulative)
700
600
500
400
300
200
100
0
10
20
Weeks
Baseline
Treatment

Figure Caption

Figure 6. (continued) Student A - Percentage of available points earned per week.

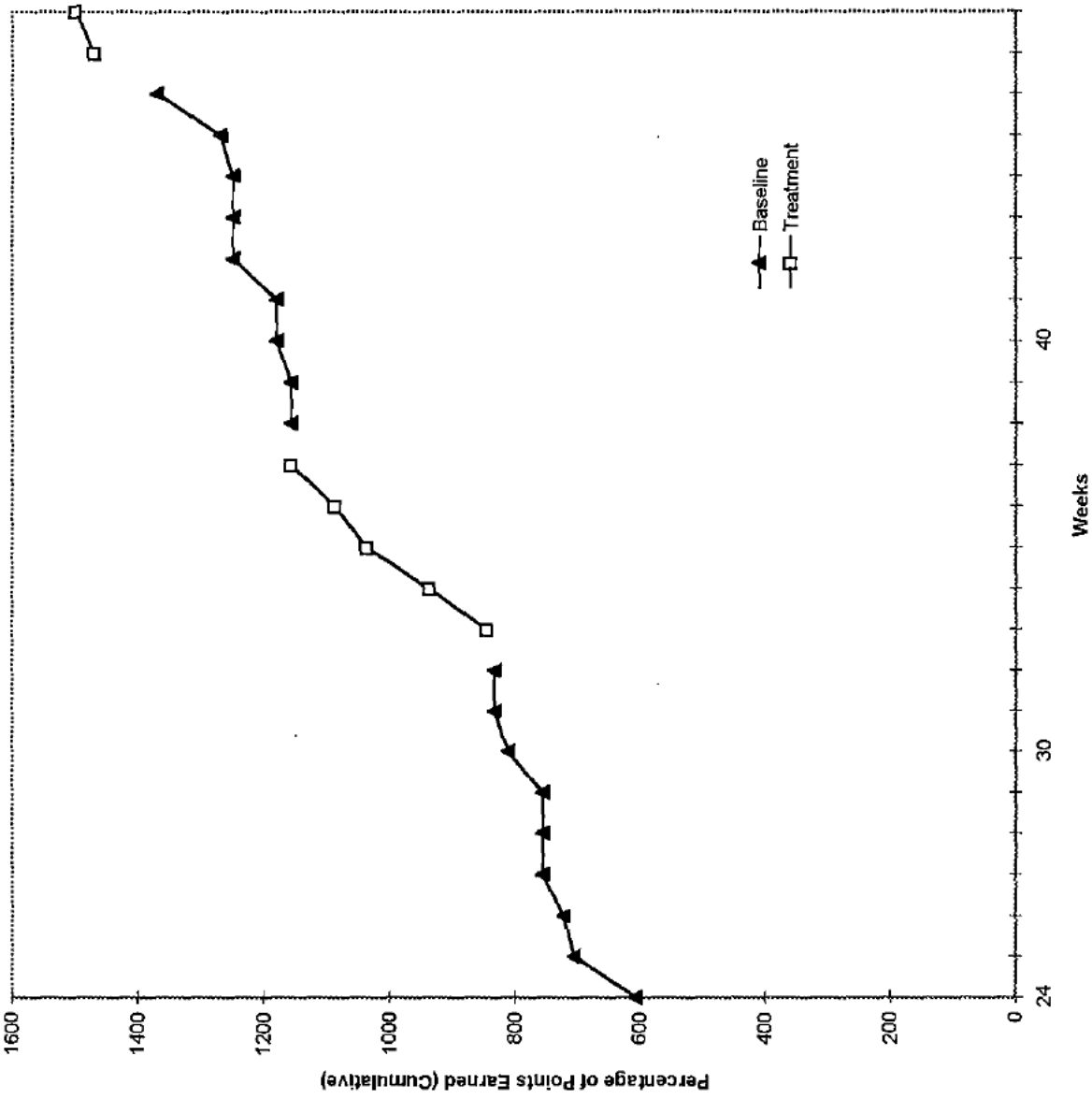

Percentage of Points Earned (Cumulative)
1600
1400
1200
1000
800
600
400
200
0
24
30
40
Weeks
Baseline
Treatment

Figure Caption

Figure 7. Student B - Percentage of available points earned per week.

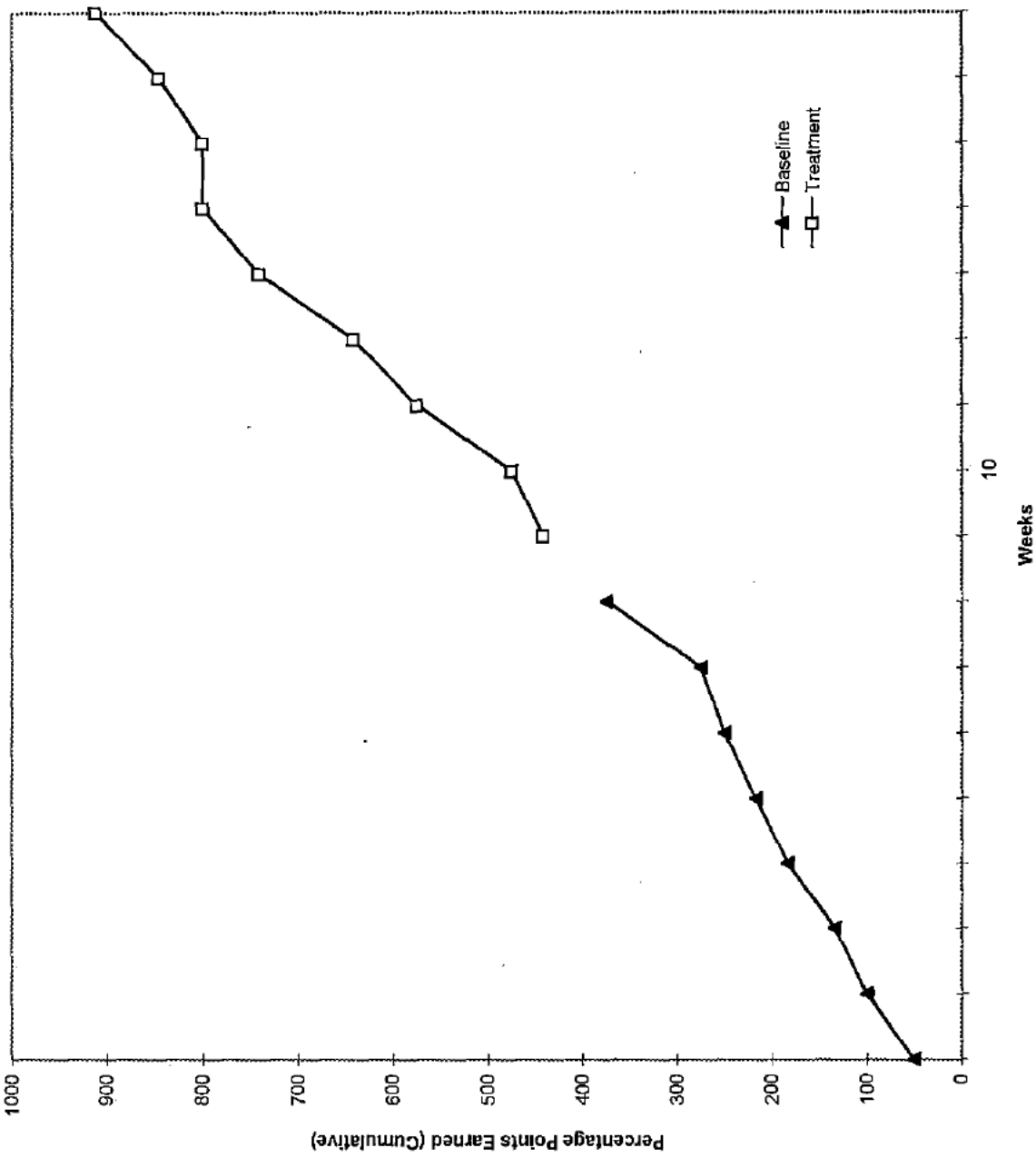

Percentage Points Earned (Cumulative)
1000
900
800
700
600
500
400
300
200
100
0
Baseline
Treatment
10
Weeks

Figure Caption

Figure 8. Student C - Percentage of available points earned per week.

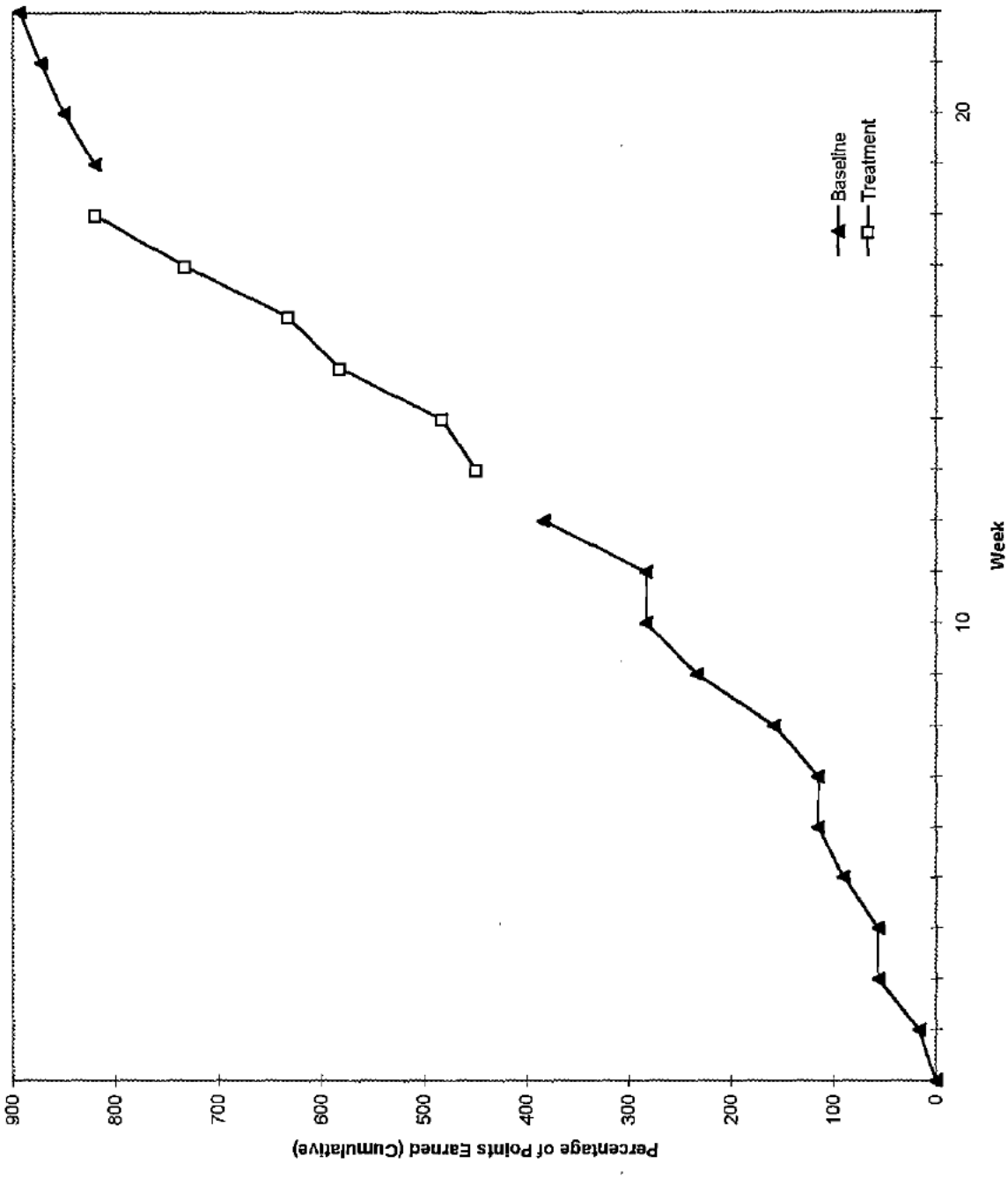

Percentage of Points Earned (Cumulative)
0
100
200
300
400
500
600
700
800
900
Week
0
10
20
Baseline
Treatment

Figure Caption

Figure 9. Student D - Percentage of available points earned per week.

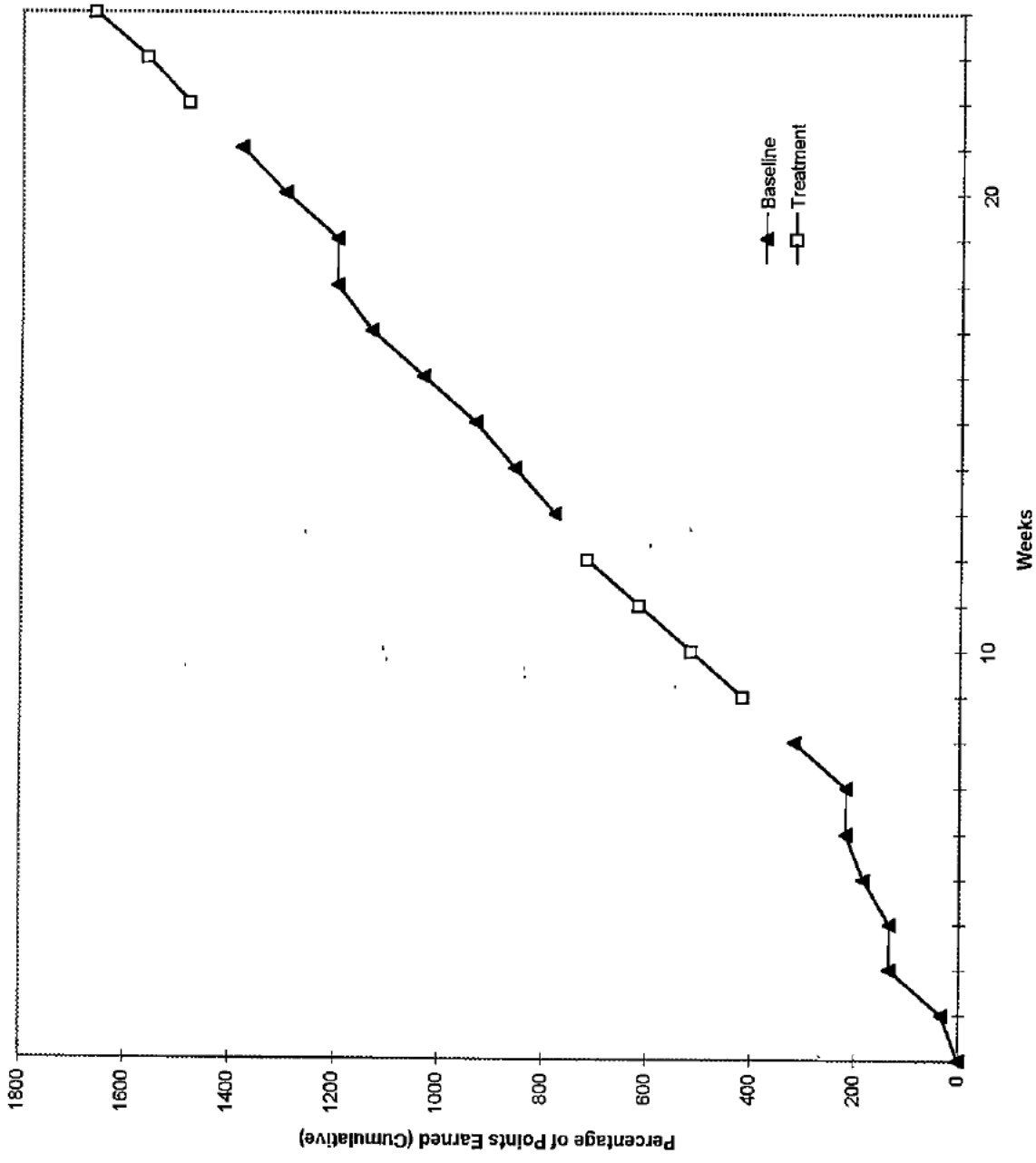

Percentage of Points Earned (Cumulative)
1800
1600
1400
1200
1000
800
600
400
200
0
Weeks
0
10
20
Baseline
Treatment

Figure Caption

Figure 10. Student E - Percentage of available points earned per week.

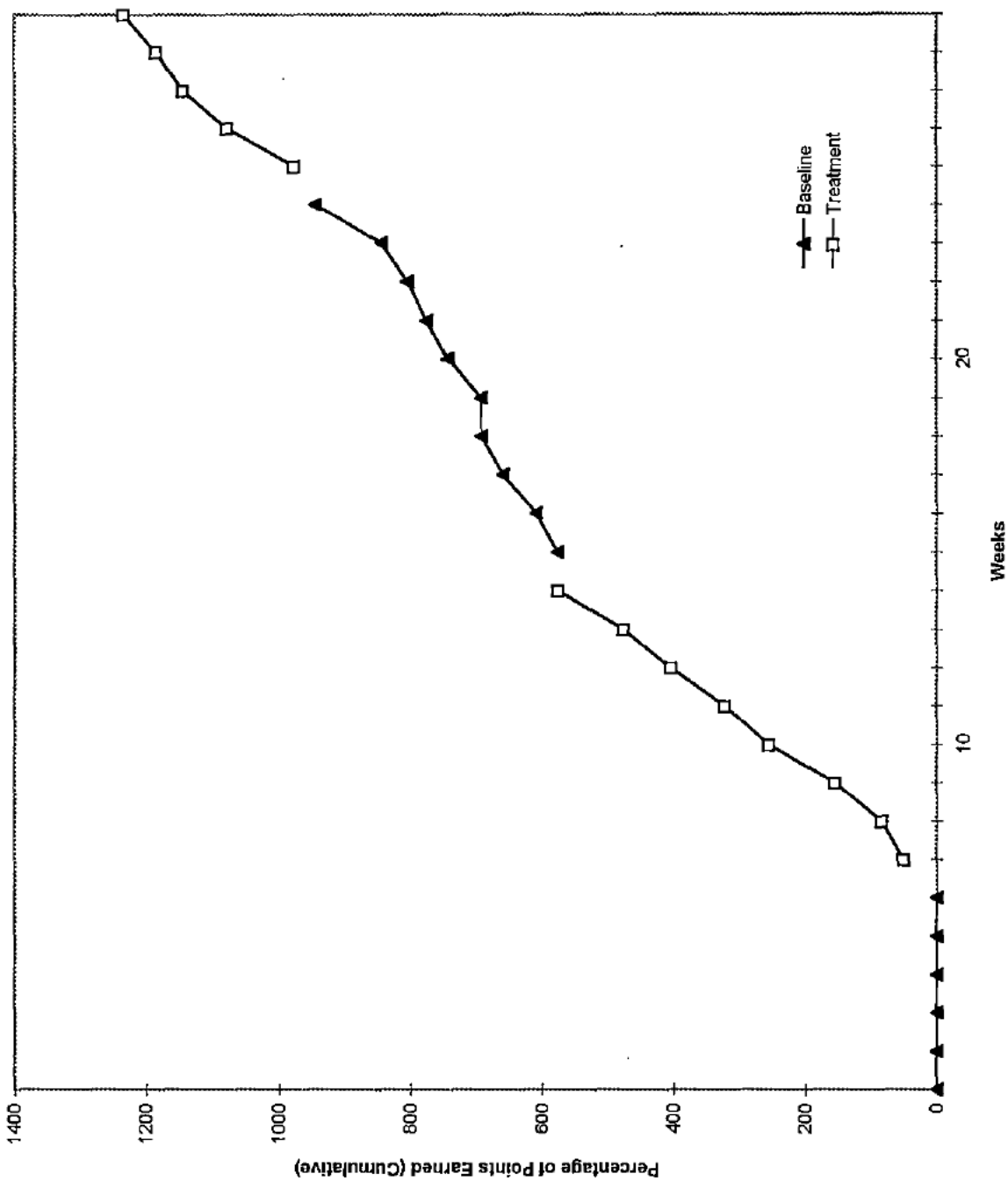
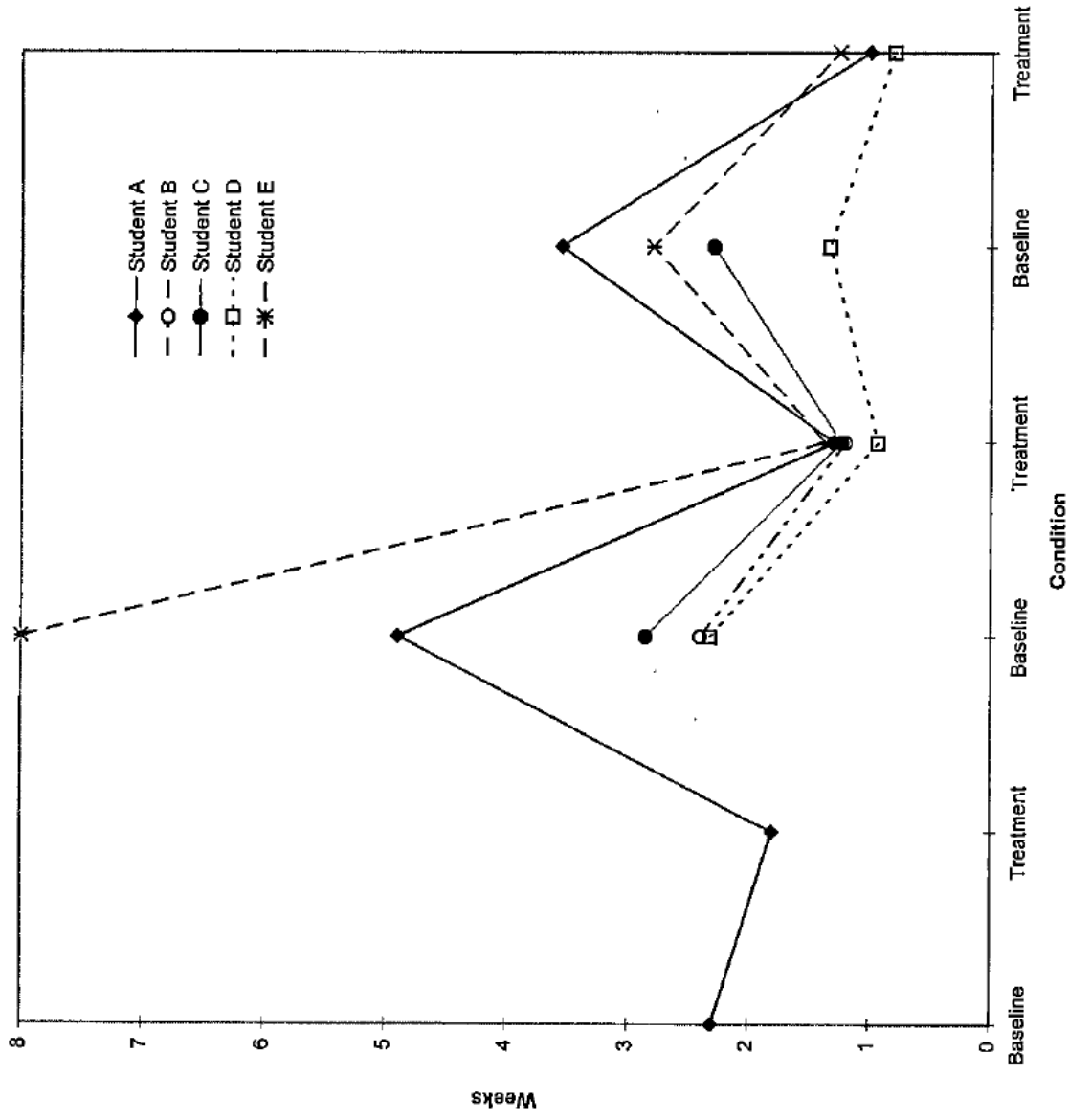

Percentage of Points Earned (Cumulative)
1400
1200
1000
800
600
400
200
0
10
20
Weeks
Baseline
Treatment

Figure Caption

Figure 11. Average number of weeks taken to master exercises by condition.


Student A
Student B
Student C
Student D
Student E
Weeks
0
1
2
3
4
5
6
7
8
Baseline
Treatment
Baseline
Treatment
Baseline
Treatment
Condition

Student B, eight exercises; Student C, four exercises; Student D, three exercises; Student E, four exercises

Choice of starting lesson with song or technique

There appeared to be little effect on what the student chose to start their lesson with across experimental conditions. Only student A showed a significant difference ($p<.05$), consistently choosing to start with songs during baseline conditions, and often choosing to start with scales during treatment conditions. All other students showed no significant difference in choice between conditions.

Interobserver reliability

Interobserver agreement was calculated by comparing raters' decisions about the acceptability of performance with the teacher's decision made at the students' lessons concerning the exercises recorded and rated. The number of rater-teacher agreements on acceptability of performance was divided by the total number of examples rated. Reliability for four raters was 92.86%, and 100% for a fifth rater. Raters included one non-musician, one beginner musician (having taken about one year of piano lessons as a child), and three experienced musicians.

Cost effectiveness

The cost of backup reinforcers was approximately $8.50. Traditional reinforcers in the form of stickers over this period of time cost approximately $20.00. However, stickers were not discontinued during the token conditions, so a direct comparison should not be made between these two costs. It is plausible, however, that a teacher would spend less money on backup reinforcers as used in the token economy than traditional reinforcers such as stickers.

Discussion

All students showed an improvement in all three technique acquisition measures when token economy contingencies were in effect. Conversely, when the token economy was suspended (return to baseline), students took longer to master their exercises, earned less points each week, and mastered fewer weekly assignments. Although these were the general results, there was great variation between students, as should be expected considering each student would be subject to different past learning histories and present contingencies (Martin and Pear, 1988).

Student A and C had been in piano the longest, and therefore had learned technique for approximately four years prior to the study. It is interesting to note that these students returned to, or even below, baseline performance levels when the token contingencies were removed. This is in sharp contrast with students D and E, who had only had a brief exposure (about eight weeks) to piano technique. These students showed some loss of improvement when tokens were no longer contingent on performance, but students D and E did not return to baseline levels of performance. It would thus seem that the amount of time a student has been instructed using traditional methods may have an effect on longer-term improvements once tokens are continued.

When considering any student's present behavior, we must also take into consideration their history of reinforcement. For example, students A and C had both been taught technique for several years with traditional techniques. Once they had demonstrated mastery of an exercise, they would be presented with verbal praise and a

sticker. However, completion of an exercise also resulted in the assignment of another, more demanding exercise. It is possible that in these cases, mastering exercises became more aversive than reinforcing, due to the fact that completion signaled assignment of a new exercise (as well as receipt of a sticker and praise). Once tokens were given contingent on performance, these students improved on all measures, suggesting that the tokens were more reinforcing than the traditional reinforcers, and that receipt of tokens managed to counter the previously acquired aversiveness. However, tokens did not appear to be reinforcing enough to make the exercises reinforcing, as indicated by the return to baseline levels of performance when the token economy was suspended. However, students D and E may not have had as many aversive contingencies applied to their technique (as they had not been playing as long as students A and C), so there would not be as much aversiveness to overcome, resulting in less of a decline in performance after tokens were discontinued.

Although it is initially discouraging to see a lack of substantial improvement beyond the treatment phase, it is to be expected when one takes into account the laws governing behavior change. Ayllon and Azrin (1968) emphasized the fact that the law of extinction is always operating, and as a result the rate of responding will decrease, often to zero, when the reinforcement given contingent on the behaviors' occurrence is ceased. Therefore, the behavior will only be maintained outside of the training situation if there is some reinforcement for it in the natural environment. In the present study, it would appear that there is no such "external reinforcement" taking place for students A and C, as extinction takes place when tokens are discontinued. However, students D and E did

not show such extinction of technique playing behaviors, suggesting that there were some reinforcement contingencies being applied outside of the training conditions, although they do not appear to be as effective as the token economy. This reinforcement in the natural environment may have involved such things as parental attention and/or praise, as these two students are siblings and show a similar pattern of responding. Also, the natural contingencies only appear to be effective after the first treatment phase has been completed, and not during the initial baseline. This would suggest that the token economy may have brought about changes in the students' home environment that were maintained to some degree even after tokens were discontinued. For example, it is possible that the students offered to play more often, bringing them into contact with social reinforcers more often, or perhaps the token economy made parents more aware of the student's performance of technique, again increasing the potential for social reinforcement from the parent in the form of praise and encouragement. Further research is needed to investigate the further reaching effects of such token economy applications.

All students showed rapid improvements in the number of weeks exercises had to be reassigned before mastery was demonstrated. These results show promise for the use of a token economy as a remedial program. For students who have exams, a token economy could be used to ensure that everything necessary is covered in a much shorter amount of time than is normally required. As time became shorter, the teacher could attempt to manipulate the economy to bring about a large short term gain, such as "raising the stakes" and offering more points for improvement, or larger backup reinforcers. The token economy is also well suited for teaching the initial steps required to master

technique. As mentioned before, learning is often tedious, and little reinforcement is available for the small increments of learning that are required initially. In the beginning, this may involve such small improvements such as sitting still at the piano, putting the hands on the proper keys, playing a few notes in succession, and so on. A token economy would ensure there was adequate immediate reinforcement for even the smallest of improvements, increasing potential for success and reducing the possibility of technique becoming aversive.

There was one negative side effect encountered in the present study that could easily happen to any music teacher who implemented a token economy. Student C performed an exercise poorly, but better than the previous week. Upon completion, just before the teacher awarded a discretionary point for the improvement, the student said "I just can't seem to do it". In a subsequent lesson, the student again followed a poorly performed exercise with such "whining" and self-deprecation behavior. This student had never before exhibited such behavior in the previous four years of lessons, and the teacher was perplexed. However, it was noted that the token was presented to the student immediately after the "whining" behavior had occurred. Without meaning to, the teacher had reinforced the whining behavior. Unfortunately, no data was taken on the occurrence of the behavior (because it was not what the teacher was attending to or meaning to reinforce), but it was felt that there was an increase to the point that the student was following almost all exercises with some form of whining and/or complaint, and becoming quite disagreeable. The teacher then became more careful in avoiding such unintentional reinforcement of undesirable behaviors, and started giving tokens to any

exercise that was improved upon AND was not followed by whining behaviors. Again, no data was collected on this behavior, but the student eventually no longer whined upon completion of an exercise.

One can see, when looking at data for individual students, that there was a great deal of variability in performance week by week. This variability may show that there is a wide range of potential home behaviors competing, and practicing technique is just one of them. If the behaviors competing with technique playing are not very reinforcing (e.g. cleaning one's room), then there is a greater possibility that the technique playing behaviors will be performed. However, if more reinforcing behaviors are competing with technique (e.g. going to the movies with friends), then technique is less likely to be played. It could be, judging from anecdotal reports from students and parents, and from the author's own experience, that there is a constant tug-of-war between various contingencies resulting in a high variability of performance. The use of token economies appears to increase the reinforcing value of technique playing, giving it a "better chance" against competing contingencies and thus increasing its performance.

It is important to note that all behaviors measured in the present study were chosen for their potential to be objectively measured. The requirements and marking criteria for technique is laid out by the Toronto Conservatory, and is not open to subjective interpretation the same way as evaluating songs. Another method music teachers use to try and assess students' performance and/ or improvement is practice records, where a student "keeps track " of the time spent practicing outside of the lesson time. This measurement, although intended to objectively measure time spent practicing,

is not at all objective as any music student who has been subject to keeping such a record will attest. Students may lie on the record to avoid aversive contingencies (such as teacher or parental admonitions and punishment), or may just forget to keep track and try to fill in the record at a later time. Also, although the record may keep track of time spent, it cannot measure the quality of that practice time. A student may be spending the practice time playing only one item over and over, or may be playing things outside of their assignments such as songs they learned in a previous grade. To apply a practice record might not only contribute to the possible aversive contingencies associated with technique playing, but it might also add to the misconception that simply repeating the technique over and over will result in improvement. The present study offers a potentially more objective assessment of home practice by relying on lesson performance, a by-product of the home practice (Martin & Pear, 1988).

The cost of backup reinforcers used in this study, in the form of small games, toys and figurines in most cases, ranged from 25 cents to $1.50 each. Although it was not done in the present experiment, a teacher could back up tokens with activities such as letting a student take a "break" from practicing/performing technique, or letting a student learn a song from outside of their program "just for fun". As well as costing nothing, these types of reinforcers allow the teacher to provide an even wider range of potential reinforcers, improving the chances that each student will have an adequate reinforcer to work towards. Recordings, music, or even field trips to concerts are all potential reinforcers that would likely benefit the students who received them and could be earned with tokens.

If there does not appear to be an appropriate reinforcer for a certain student, the teacher could easily ask the student for suggestions about reinforcers, and make a "deal" with the student regarding the number of tokens required to earn the reinforcer. This was done with both students B and D in their second token economy conditions, with a higher grade-level piece being desired and redeemed as a reinforcer. The teacher then asked the students what "price" they would like to attach to the item, and in both cases the students suggested a higher price than the teacher! In fact, the teacher had set the most desired reinforcers at 75 points each, but these specialized reinforcers were both deemed to be worth 100 points each by the students who requested them.

Outside of the lesson situation, parents could become involved in the token economy. Parents could assist by providing the teacher with specialized reinforcers, such as letting the student have a party or taking the student out to a movie, in return for tokens accumulated at the lesson. In these cases, a voucher could be made up with the activity described on it, and thus the voucher could be presented among the tray of reinforcers for the appropriate student's lesson only. Also, the use of a voucher would allow the "immediate" receipt of the reinforcer, even though in this case it would simply mean the exchange of one type of token for another token, to later be exchanged for the activity. Beyond this, parents could implement token economies at home, reinforcing various practicing and performing behaviors. In this case, the teacher could outline basic behaviors (i.e. non-technical) that the parent could identify, such as playing each song and exercises at least once per practice session, and the points to be awarded for each. These points could then be exchanged at the lesson, with both lesson and home points being

combined, or the parent could be in charge of the backup reinforcers for the home points, keeping the two economies separate.

The use of a token economy can not only help the student improve, but can also help the teacher improve his/her teaching methods. It is always easy to pick out the mistakes a student makes, and this can lead to negativity and criticism. With a token economy, a teacher can be made more aware of how often they are reinforcing their student, and they can "force" themselves to be more positive by setting out, as in the present study, a certain number of tokens to be handed out during any one lesson. For example, perhaps a teacher has a particularly "bad" student that has to be constantly corrected. Under normal circumstances, the teacher may be liable to follow any playing with a list of corrections to be made, and passages that need more work. This simply tells the student what *not* to do, and doesn't give the student a list of what to do instead. The teacher in this case is not likely to give much reinforcement to the student, or at least the reinforcement will not be as plentiful as the punishment (in the form of corrections and criticisms). By implementing a token economy, the teacher can force him/herself to give the student a point or two for something that was done correctly, no matter how small, in addition to a criticism or correction. Not only does this increase the overall reinforcement gained by the student, and hence decrease the potential for aversiveness throughout the lesson, but it also gives the student feedback as to what behaviors are being performed correctly. This gives the student a "starting point" to work from, and the teacher a chance to begin the shaping procedure. For example, perhaps the only thing the student is doing correctly is playing the first bar correctly. If the teacher reinforces the student for

the first bar, and then makes the necessary changes to the second bar, then the next time it should be possible to reinforce the proper playing of the first two bars, and so on. As many mistakes made in musical instrument acquisition are repetitive (i.e. the student who makes many mistakes often is really only making a few mistakes many times over), then the shaping process should progress quickly, and both student and teacher can avoid the negative cycle of complaining and not improving.

A token economy such as the one used in the present study need not be restricted to easily-measured exercises such as technique. With a little creativity, the teacher can use the tokens to reinforce any adaptive behavior at the lesson. For example, often with little children attention behaviors such as actually sitting at the piano for any length of time are lacking. A teacher could reinforce the student for first of all sitting correctly, and then gradually increase the criteria, such as requiring that the student sit for a longer period of time to earn the token. Posture, tone, tempo, and the like are all behaviors that could be improved with a token economy. Even the learning of pieces could be broken down and reinforced accordingly, such as first learning a song with each hand separately and then together. The criteria for these behaviors is more subjective than those for technique, so the teacher will be forced to make judgments about improvement. However, as was mentioned earlier, if the teacher first reinforces the student for those behaviors that were correct, the student will "know" what the teacher's criteria are, and corrective comments will likely be better understood and followed.

Summary

The present study has shown how the application of a token economy to piano technique teaching can improve student performance, and mention has been made as to possible improvement to teaching techniques. Further research must be made on this latter subject, as well as into the longer-term effects of implementing such a method. It is possible that students who start learning technique under a token economy would improve even faster, and the effects could be longer lasting and further reaching (e.g. generalize to other piano playing behaviors). Also, all of the students involved in the present study were children, so further research should be done with other age groups, such as adult beginners and older, experienced pianists.

The efficacy of token economy programs has been shown repeatedly with various behaviors and subject populations. Although little has been done in the field of music instruction, the present study indicates that here, too, the use of a token economy can improve student performance. With further research, we should be able to ascertain the longer-term, further reaching effects and wider application of token economies on all aspects of instrument learning and teaching which appear to hold much promise of improvement.

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VITA

Surname: Picone Given Names: Tracey Ralene Teresa

Place of Birth: Victoria, British Columbia, Canada

Educational Institutions Attended:

University of Victoria 1989 to 1996

Degrees Awarded:

B.A. University of Victoria 1993

Honors and Awards:

Graduate Teaching Fellowship 1994-1996
Norma M. Wilson Graduate Bursary 1995-1996

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Title of Thesis:

Application of a Token Economy in Teaching Piano Technique

Author [redacted]

Tracey Ralene Teresa Picone
February 27, 1996