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AUTOGESTION ET REPRÉSENTATION GRAPHIQUE DES PROGRÈS DES ÉLÈVES DANS UN CONTEXTE DE DIDACTIQUE DE PRÉCISION

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CBM	Curriculum-based measurement
DI	Direct Instruction
EBSCC	Excel-based standard celeration chart
EMSDC	Electronic modified standard daily chart
JRCECC	Judge Rotenberg center exclusive celeration chart
NRP	National reading panel
PT	Precision Teaching
SACC	Standard alternate celeration chart
SCC	Standard celeration chart
SC*listserv*	Standard celeration LISTSERV (software)

RÉSUMÉ

Récemment, sous forme de chapitres de livres, d'articles scientifiques et de programmes de congrès de l'*Association for Behavior Analysis International*, l'enseignement direct et la didactique de précision sont davantage mentionnés par de nombreux auteurs, autant dans les domaines de la psychologie, de l'éducation que de l'analyse appliquée du comportement. Cette thèse doctorale s'intéresse à l'autogestion des apprentissages scolaires, plus précisément aux effets de l'auto-inscription graphique sur la fluidité en lecture à l'aide de la didactique de précision et aux nombreux graphiques standards et alternatifs permettant l'auto-inscrition graphique. Deux articles sont présentés et répondent ensemble à ces champs d'intérêts principaux.

Le premier article présente une recension des écrits scientifiques sur l'autogestion des apprentissages plus précisément sur l'auto-inscription graphique. Le but de cette recension est de créer un inventaire des graphiques utilisés en éducation, plus distinctement en didactique de précision. L'accent est mis sur l'auto-inscription graphique du rendement scolaire et sur les nombreux avantages d'une telle pratique comme le sentiment de confiance en soi et l'amélioration du rendement scolaire des élèves. Bien que l'accent soit mis sur la didactique de précision, les méthodes de l'Enseignement Direct et du Curriculum-based Measurement sont brièvement décrites et examinées, car elles utilisent toutes les deux des graphiques en milieux éducationnels. Malgré le fait que la didactique de précision a été utilisée en éducation et en analyse appliquée du comportement depuis les 40 dernières années, aucune analyse critique des graphiques en didactique de précision, incluant les graphiques standards et ceux qui sont dits alternatifs, autant papiers qu'informatisés, n'a été publiée à ce jour. Cet inventaire critique est impératif en permettant à la fois des praticiens et des chercheurs intéressés par le suivi et la modification des comportements d'acquérir des connaissances sur les différents graphiques disponibles, et pour évaluer leurs avantages et inconvénients respectifs. En outre, un intérêt marqué pour les graphiques informatisés et l'apparition de nouveaux graphiques alternatifs dans le monde de la didactique de précision ravive l'intérêt pour celle-ci et l'auto-inscription graphique. Finalement, une analyse comparative détaillée des caractéristiques et avantages des graphiques papiers et informatisés a suggéré la supériorité des graphiques et procédures informatisés.

Le deuxième article présente les résultats d'une étude empirique sur une intervention d'autogestion, plus précisément sur les effets de l'auto-inscription graphique sur la fluidité en lecture de phonèmes francophones à l'aide de l'Enseignement Direct, de la didactique de précision et des procédures prescrites par ce type d'enseignement. Dans un cours de français comme langue seconde, 63 élèves de septième et huitième année ont inscrit leurs résultats en lecture chronométrées pendant 13 semaines. L'auto-inscription graphique a été notée à l'aide d'un graphique papier alternatif de la didactique de précision, le *Standard Alternate Celeration Chart*, provenant du graphique standard de la didactique de précision, le *Standard Celeration Chart*, graphique couramment utilisé dans ce domaine. Le premier objectif de recherche vise à examiner les effets de l'auto-inscription graphique régulière et moléculaire sur la fluidité en lecture de phonèmes francophones par des élèves typiques. Le deuxième objectif de recherche est de comparer les effets de l'auto-inscription graphique sur la fluidité en lecture des élèves typiques qui présentent un faible rendement scolaire de ceux qui présentent un rendement scolaire plus élevé. L'étude se veut inductive et utilise quatre niveaux de base multiples, répartis en fonction des quatre classes de français comme langue seconde. Malgré les résultats des analyses de la didactique de précision (i.e., les droites de régressions linéaires, appelées *célérations*) indiquant de faibles coefficients de célération en niveaux de base et durant la phase de traitement, les analyses statistiques classiques (i.e., ANOVA et effets simples) indiquent que les élèves lisent de façon plus fluide les phonèmes francophones durant la phase de traitement plutôt qu'en niveau de base. Ceci indique que l'étude sur l'auto-inscription graphique à l'aide du *Standard Alternate Celeration Chart* a permis d'observer un effet positif général sur la fluidité en lecture des élèves en analysant les moyennes de rendement en lecture de phonèmes francophones des élèves, mais non en analysant les pentes de célération. La comparaison des élèves typiques suivant une dividion *post-hoc* en groupes de rendement scolaire faible vs élevé montre que les moyennes des élèves du groupe à rendement scolaire faible sont plus basses durant le niveau de base et durant la phase de traitement que celles des élèves à rendement scolaire plus élevé. Cependant, la comparaison de l'amélioration de la fluidité en lecture des premiers est de près de deux fois plus élevée que celle des derniers. Ceci suggère que les élèves à rendement plus faible ont bénéficié d'un enseignement explicite tel qu'offert par la didactique de précision et l'Enseignement Direct. Ces résultats sont en accord avec ceux qui sont rapportés par les écrits scientifiques en Enseignement Direct. Des explications concernant ces résultats sont offertes dans la section discussion.

Mots clés : didactique de précision, Enseignement Direct, autonotation, auto-inscription graphique, graphique informatisé, graphique alternatif, rendement scolaire

INTRODUCTION

Depuis plus de 40 ans, l'enseignement direct et la didactique de précision, deux modèles d'enseignement comportemental qui misent, entre autres, sur l'évaluation régulière des apprentissages scolaires des élèves, sont associés à l'analyse appliquée du comportement (Adams & Engelmann, 1996 ; Becker, 1992 ; Carnine & Silbert, 1979 ; Giroux, 1976 ; Graf & Lindsley, 2002 ; Lindsley, 1971 ; West & Young, 1992 ; White, 1986 ; White & Haring, 1980). L'enseignement direct et la didactique de précision sont deux méthodes d'enseignement explicite (Rosenshine, 1986) dans la mesure où elles insistent sur d'une part l'importance d'un niveau élevé de maîtrise des connaissances et des habiletés visées par le programme et d'autre part sur l'apprentissage par étapes séquentielles, allant du simple au complexe et sur la construction d'un rendement fluide (angl. *fluency building*). Ce dernier concept qui englobe les notions de précision et de rapidité d'exécution d'une tâche est particulièrement important en didactique de précision (Binder, 1988, 1996, 2003, 2004 ; Bloom, 1986 ; Chiesa & Robertson, 2000 ; Forget, 2009). Cela dit, pendant plusieurs années, l'importance relative accordée par l'analyse appliquée du comportement à ces deux méthodes fut relativement discrète. Au cours des dernières années, l'augmentation substantielle du nombre d'articles, de chapitres de volumes et de conférences présentées lors du congrès annuel de *l'Association for Behavior Analysis International* (la société la plus importante dans le domaine de l'analyse appliquée du comportement) qui sont consacrés à ces deux pratiques éducatives est telle qu'il est impossible d'ignorer leurs contributions respectives (Bissonnette, Richard, & Gauthier, 2006 ; Boyer, 2010 ; Calkin, 2005 ; Calkin et al., 2011 ; Carnine, Silbert, Kame'enui, & Tarver, 2010 ; Cooper, Heron, & Heward, 2007 ; Ellis, 2001 ; Filer & Kozma, 2010 ; Fredrick, Deitz, Bryceland, & Hummel, 2000 ; Graf & Lindsley, 2002 ; Heward, 2008 ; Kozma, 2011 ; Marchand-Martella, Slocum, & Martella, 2004 ; Moran & Malott, 2004 ; Schuessler & Forget, 2009 ; Slocum, 2004 ; Stockard, 2010a ; Vargas, 2009 ; Vitale, Medland, & Kaniuka, 2010). En effet, depuis le rapport du *National Reading Panel* (2000), une attention spéciale est portée aux méthodes préconisant l'enseignement explicite, par exemple, de la phonétique ainsi que le concept de la fluidité en lecture, concepts au coeur de l'enseignement direct et de la didactique de précision. Neuf ans plus tard, le *Réseau Canadien de Recherche sur le Langage et l'Alphabétisation* (2009) a émis un rapport confirmant les conclusions du *National Reading Panel* et recommande aussi l'enseignement explicite pour l'apprentissage de la lecture et de l'écriture en français.

L'Enseignement Direct

L'Enseignement Direct est un programme d'enseignement très structuré des apprentissages, centré sur la tâche et sur l'enseignant (Bereiter & Engelmann, 1966). Les travaux d'Engelmann et collègues ont généré des curricula d'enseignement explicite de la lecture, de l'écriture et des mathématiques au primaire et au secondaire et les écrits scientifiques réfèrent à ceux-ci en utilisant des lettres majuscules (angl. *Direct Instruction – DI* ; Adams & Engelmann, 1996 ; Bereiter & Engelmann, 1966 ; Carnine et al., 2010 ; Engelmann & Carnine, 1991 ; Engelmann, Haddox, & Bruner, 1983 ; Engelmann, Hanner, & Johnson, 1999a, 1999b ; Marchand-Martella et al., 2004 ; Stein, Kinder, Silbert, & Carnine, 2006). Rosenshine (1979, 1986, 2009) partage certainement une vision similaire d'Engelmann et collègues en ce qui a trait à la définition de l'enseignement direct (lettres minuscules), sans toutefois renvoyer à un curriculum en particulier. L'enseignement direct est défini, selon Rosenshine, par des activités engendrées par l'enseignant et directement liées au progrès dans le rendement scolaire des habiletés de base en lecture et mathématiques. Les buts de l'enseignement prodigué doivent êtres clairs pour les élèves. Une période d'exercices répétés des nouvelles habiletés est nécessaire et primordiale pour consolider les apprentissages. Cependant, les curricula d'Engelmann et collègues vont au-delà des similitudes de la définition de Rosenshine (1986) : ils contiennent des séquences précises d'introduction et d'enseignement des concepts, centrées sur l'enseignant. Il n'y a pas de programme d'enseignement s'appuyant sur des recherches empiriques comme le sont ceux de l'Enseignement Direct où chacune des leçons a été préalablement testée sur le terrain afin de s'assurer de son efficacité (Adams & Engelmann, 1996 ; Becker, 1992 ; Engelmann, 1992). Les deux règles fondamentales de l'Enseignement Direct sont d'enseigner plus de contenus en maximisant le temps d'enseignement et de contrôler de façon détaillée l'enseignement. La première règle concerne le transfert des apprentissages par l'enseignement des habiletés de base et de règles générales s'appliquant à diverses situations (p. ex., l'enseignement d'une quarantaine de sons en anglais permet de lire plus de 10 000 mots couramment utilisés avec ces mêmes sons). La deuxième règle, le contrôle détaillé de l'enseignement, s'effectue par l'utilisation de plusieurs outils et par la mise en place de stratégies d'enseignement et de gestion de classe. Par exemple, lors de l'enseignement d'un concept, les enseignants utilisent des scénarios où chacun des mots est choisi avec soin et l'improvisation est minime pour assurer la compréhension de tous les élèves. Les enseignants doivent êtres formés aux rudiments de l'Enseignement Direct et à l'utilisation appropriée du matériel (curricula). Les acquis des élèves sont continuellement évalués afin de s'assurer de la qualité de l'enseignement prodigué et du rendement de l'élève dans son groupe. Les enseignants, leurs superviseurs, les administrateurs et les parents utilisent des manuels détaillés des procédures de l'Enseignement Direct afin de s'assurer de la qualité d'implantation du modèle dans une école donnée (Becker, 1992 ; Carnine et al., 2010 ; Ellis, 2001 ; Engelmann, Becker, Carnine, & Gersten, 1988).

L'efficacité du modèle d'Enseignement Direct a été déterminée lors du plus grand et du plus dispendieux projet de recherche réalisé dans le domaine de l'éducation aux États-Unis. En effet, le projet *Follow Through,* mené à la fin des années soixante, est estimé à plus d'un demi-milliard de dollars (Ellis, 2001 ; Péladeau & Legault, 2001 ; Stebbins, St-Pierre, Proper, Anderson, & Cerva, 1977 ; Watkins, 1997). *Follow Through* a comparé 13 modèles d'enseignement ; certains s'appuyant sur l'enseignement des habiletés scolaires de base, comme la lecture et les mathématiques (dont l'Enseignement Direct fait partie). D'autres modèles cognitivistes ou affectifs se sont concentrés, par exemple, sur les habiletés complexes de résolution de problèmes ou sur le développement d'habiletés affectives telle que l'estime de soi. Les résultats de *Follow Through* ont démontré qu'au terme de trois ans d'application, les milliers d'élèves de l'Enseignement Direct arrivent premiers devant les élèves des autres modèles en ce qui concerne les habiletés de base comme la lecture, l'écriture et les mathématiques, ce qui est attendu de ce modèle (Stebbins et al., 1977). Faits remarquables, les élèves de l'Enseignement Direct se classent aussi premiers sur les tests d'habileté cognitive, ainsi que sur les mesures d'estime de soi. Sur l'ensemble des mesures recueillies, les élèves qui ont bénéficié de l'Enseignement Direct dépassent le 50^{e} percentile, alors que les élèves des autres modèles ainsi que les élèves des classes du groupe de contrôle ne dépassent pas le 20^{e} percentile à l'échelle nationale (Becker, Engelmann, Carnine, & Rhine, 1981). Becker (1992) rapporte que les élèves de milieux défavorisés qui ont commencé en maternelle avec le modèle d'Enseignement Direct de *Follow Through* terminent leur troisième année du primaire avec un rendement scolaire digne d'un niveau de 5.2 années scolaires en lecture. De nombreuses méta-analyses rapportent non seulement la supériorité du modèle de l'Enseignement Direct, mais également qu'aucune étude ne démontre des résultats en faveur des élèves des groupes de contrôle (Adams & Engelmann, 1996 ; Cotton & Savard, 1982 ; White, 1988). De plus, comme Ellis (2001) le mentionne, la robustesse de la recherche effectuée en Enseignement Direct n'est aucunement compromise par l'affiliation avec le développement commercial du modèle et la qualité des périodiques de publication. En effet, il n'y a aucune différence dans les résultats rapportés par les différentes études et ce, que l'auteur bénéficie du développement ou non de l'Enseignement Direct ou encore que les recherches soient publiées dans des périodiques prestigieux et évaluées par les pairs comparativement aux périodiques qui ne le sont pas.

Finalement, il n'y a aucune critique substantielle présente dans les écrits scientifiques concernant la qualité de la recherche effectuée en Enseignement Direct (p. ex., devis expérimentaux, analyses statistiques) et la robustesse des conclusions provenant du projet *Follow Through* (Anderson, St-Pierre, Proper, & Stebbins, 1978 ; Becker & Carnine, 1981 ; House, Glass, McLean, & Walker, 1978).

Au moins cinq millions d'élèves ont bénéficié du modèle de l'Enseignement Direct depuis les années 70 (Becker, 1992). Les curricula de l'Enseignement Direct sont utilisés dans plusieurs pays comme le Canada (anglophone), les États-Unis, l'Angleterre, huit pays de l'Afrique (l'Afrique du sud, le Kenya, la Tanzanie, le Malawi, le Zimbabwe, la Swaziland, la Mauritanie, le Botswana), le Japon et en Australie (Becker, 1992 ; Booth, Hewitt, Jenkins, & Maggs, 1979 ; Branwhite, 1982 ; Hempenstall, 2006 ; Lockery & Maggs, 1982 ; Maloney & Somers, 2001 ; Nakano, Nageyama, & Kinoshita, 1993 ; Schieffer, Marchand-Martella, Martella, Simonsen, & Waldron-Soler, 2002 ; Van Rensburg, 1982). L'Enseignement Direct comporte plus de 100 curricula (Carnine et al., 2010). *Reading Mastery I* et *II* sont des exemples de programmes s'adressant aux élèves présentant un rendement scolaire plus faible. *Reading Mastery Fast Cycle*, est un exemple de programme pour les élèves présentant un rendement scolaire plus élevé. L'Enseignement Direct est utilisé avec différentes clientèles comme les élèves apprenant l'anglais (Berry, 2011), les élèves de classes bilingues anglais-espagnol (Gersten, Brockway, & Henares, 1983), les élèves ayant un trouble du spectre de l'autisme (Taylor & Whiteside, 2011) et des élèves ayant subi un traumatisme crânien

(Glang, Singer, Cooley, & Tish, 1992). Depuis les 37 dernières années, des ateliers de formation et de perfectionnement au modèle d'Enseignement Direct sont offerts à la conférence annuelle de l'*Association for Direct Instruction* comptant des miliers de membres à son actif.

La didactique de précision

La didactique de précision, dans sa définition même, n'est pas une méthode d'enseignement ni un curriculum en tant que tel : c'est un outil d'observation et d'évaluation des acquis des élèves. Créée dans les années soixante par Lindsley (1964, 1972, 1992, 2010) dans des classes spéciales au centre médical de l'Université du Kansas à l'unité de réhabilitation pour enfants, la didactique de précision est proposée comme une méthode de vérification systématique et permanente des apprentissages. La didactique de précision permet aux praticiens et aux chercheurs d'évaluer tous comportements observables et mesurables (personnels, affectifs, moteurs, scolaires, linguistiques, etc.) et elle peut être combinée avec n'importe quel curriculum ou technique d'enseignement (Giroux & Lévesque, 2001 ; Lindsley, 1971, 1997, 2010 ; West & Young, 1992 ; White, 1986 ; White & Haring, 1980). La didactique de précision s'articule autour d'un graphique standard, le *Standard Celeration Chart*. Ce graphique semi-logarithmique a une ordonnée composée de six cycles de multiples de 10 et d'une abscisse divisée en espaces égaux représentant les jours de la semaine. L'ordonnée semi-logarithmique permet de noter des fréquences de comportements sur une minute ; d'un comportement par jour à 1000 comportements par minute sur un seul et même graphique.

Selon Stein et Kinder (2004), la conscience phonologique et la connaissance des lettres de l'alphabet sont des facteurs de prédiction importants des futures habiletés en lecture. Frederiksen (1981) démontre que les taux de fréquence en lecture prédisent les niveaux de rendement scolaire. Donc, en mettant l'accent sur les mesures de fluidité des élèves (les mesures de rapidité et de précision d'exécution d'une tâche, par exemple le nombre de mots lus correctement en une minute), les enseignants peuvent modifier et personnaliser l'enseignement afin de maximiser l'acquisition des habiletés (Kubina, 2005). Comme le progrès des élèves est indiqué par une pente de *célération* (droite de régression linéaire ; White, 2010), les enseignants peuvent utiliser celle-ci pour identifier ceux en difficulté ou au contraire ceux dont le rendement s'est amélioré et qui peuvent réintégrer la classe ordinaire.

Le *Great Falls, Precision Teaching Project* est une étude réalisée aux États-Unis auprès d'élèves du primaire pendant une durée de trois ans (Beck, 1979 ; Beck & Clement, 1991 ; Binder, 1988, 2004). Cette étude compare le rendement d'élèves à l'aide du *Iowa Test of Basic Skills*, un test normalisé des habiletés scolaires de base, comme la lecture et les mathématiques. Les élèves du groupe expérimental utilisent la didactique de précision pendant 20 à 30 minutes par jour en plusieurs séances d'exercices d'une durée d'une minute. Les élèves du groupe de contrôle utilisent le même curriculum et la même méthode d'enseignement dont bénéficient les élèves du groupe expérimental mais ne reçoivent pas de séances de didactique de précision. Les élèves du groupe expérimental ont augmenté de 20 à 40 points percentiles leur rendement aux différents sous-tests du *Iowa Test of Basic Skills* (Binder, 2004). Une autre étude, plus modeste, fut réalisée auprès d'étudiants universitaires dans le dessein d'évaluer le maintien des acquis comparant un enseignement traditionnel avec ou sans didactique de précision (Olander, Collins, McArthur, Watts, & McDade, 1986). Les étudiants ont démontré un maintien des acquis plus important en utilisant la didactique de précision que les étudiants du groupe de contrôle.

Il n'existe pas de méta-analyse établissant l'efficacité de la didactique de précision en comparaison avec d'autres méthodes ou curricula. Son pouvoir d'observation permet d'établir un diagnostic tout comme l'analyse appliquée du comportement permet une évaluation clinique sans être un traitement en tant que tel (Hayes & Follette, 1992). La didactique de précision s'insère davantage dans une tradition de publication d'étude de cas. Au congrès de l'*Association for Behavior Analysis International* de l'an 2000, Calkin (2002a) a présenté un estimé de 1,197,198 de *Standard Celeration Charts* qui furent utilisés depuis leur création. Un nombre important d'études empiriques démontrant l'étendue de l'utilisation de la didactique de précision est présent dans les écrits scientifiques tant sur le plan des apprentissages scolaires (Fitzgerald & Garcia, 2006 ; Giroux & Forget, 1996 ; Spence, 2002 ; Sulgrove & McLaughlin, 2004 ; White, 2002), des apprentissages sociaux, qu'en modification de comportement (Lovett, 2004 ; Mason, 1985 ; Schuessler & Forget, 2009 ; Smyth & Hardy, 2002 ; Zambolin, Fabrizio, & Isley, 2004), que pour tout autre apprentissage tels que jouer du piano (Calkin, 2002b), apprendre le russe (Calkin, 1996), améliorer son rendement au golf (McDowell, McIntyre, Bones, & Keenan, 2002), à la course à pied (McGreevy, 1984), ou au ballet (Lokke, Lokke, & Arntzen, 2008). La didactique de précision est aussi utilisée pour noter et enregistrer certaines réactions très spécifiques comme la fréquence des mouvements fœtaux (Calkin, 1983), le nombre d'élèves recevant un diplôme relié au financement de l'établissement d'enseignement (Stephens, 2004) ou de la publication des écrits d'un auteur (Commons, 2003).

L'auto-inscription graphique, au cœur même de la didactique de précision, est définie par le fait que les élèves inscrivent eux-mêmes leur rendement scolaire (p. ex., le nombre de mots lus par minute) ou tout autre comportement (p. ex., respecter une consigne) sur un graphique (White & Haring, 1980). Selon Lindsley (1991), ainsi que Smith, Best, Stubbs, Archibald, et Roberson-Nay (2002), l'inscription graphique du progrès d'un élève à travers le temps lui offre, ainsi qu'à l'enseignant, une représentation visuelle plus adéquate de ses acquisitions et de son progrès que l'utilisation d'inscription sur un tableau quelconque. En effet, le graphique montre le cheminement d'un élève à chaque inscription sur celui-ci. La pente illustre l'amélioration ou la diminution d'un comportement ciblé. De nombreux avantages à l'utilisation des procédures de la didactique de précision sont mentionnés par différents auteurs. Lindsley (1990a) note le sentiment de confiance établie entre un élève et son enseignant et les habiletés d'autogestion apprises chez les élèves. Rock (2005) mentionne une augmentation du rendement scolaire. DiGangi, Maag, et Rutherford (1991), Gunter, Miller, Venn, Thomas, et House (2002), Moxley (2007) et Sutherland et Snyder (2007) mentionnent une réduction des responsabilités et du temps d'enseignement de l'enseignant. Finalement, Gunter et collègues (2002) et Moxley (2007) démontrent que les élèves prennent plaisir à l'auto-inscription graphique.

Les thématiques de recherches actuelles

Des champs d'intérêt plus particuliers mais toujours reliés à l'efficacité des modèles éducationnels ont été récemment étudiés; en Enseignement Direct, les enfants en difficulté d'apprentissage dont les parents ont un diplôme d'études supérieures (Hempenstall, 2004), l'intensité de l'Enseignement Direct prodigué (Shippen, Reilly, & Dunn, 2008), les élèves dont la langue d'usage est autre que l'anglais (Berry, 2011 ; Engelmann, Engelmann, & Silbert, 2011) et l'efficacité de différents aspects des curricula d'Engelmann et collègues

(Stockard, 2010b ; Tobin & Calhoon, 2009). Vitale et Kaniuka (2009) s'intéressent aux barrières dont fait face le programme *Corrective Reading*, programme d'Enseignement Direct (Engelmann et al., 1999b) en contexte de réforme scolaire. Les éléments considérés idéals d'un programme d'appoint en lecture pour les enfants à risque par les enseignants du primaire, et la perception des faiblesses du programme d'appoint en lecture *Corrective Reading*, ont fait l'objet d'une investigation. Les résultats de l'étude informent et inquiètent. D'une part, un portrait des attentes et des perceptions des enseignants face à un programme d'appoint idéal en lecture pour élèves en difficulté se dessine. D'autre part, les perceptions des faiblesses du programme *Corrective Reading*, rapportées par les enseignants, sont en contradiction avec les principes fondamentaux de ce qui le rend efficace (Engelmann & Carnine, 1991).

En didactique de précision, les recherches sur les clientèles atypiques, comme les enfants ayant un trouble du spectre de l'autisme, sont continuellement mise à jour par de nombreux chercheurs (Fabrizio & Moors, 2003 ; Kubina & Yurich, 2009 ; Rivard, 2011 ; Schuessler & Forget, 2009 ; Weiss, Fiske, & Ferraioli, 2008). L'informatisation du graphique et des procédures de la didactique de précision est également une thématique de recherche importante (Harder, 1998 ; Péladeau 2001, 2003 ; Regli, Giroux, & Frenette, 2010a, 2010b ; Rivard, 2011 ; Schuessler & Forget, 2009).

L'alliance de l'Enseignement Direct et de la didactique de précision est présente dans les écrits scientifiques depuis près de 20 ans et ce, malgré le fait qu'elles sont très peu utilisées conjointement par les enseignants (Blackwell, Stookey, & McLaughlin, 1996 ; Edmondson, Peck, & McLaughlin, 1996 ; Holz, Peck, McLaughlin, & Stookey, 1996 ; Kubina, Commons, & Heckard, 2009 ; Legault, Maloney, & Giroux, 2001 ; Maloney, Desjardins, & Broad, 1990 ; Stenseth & McLaughlin, 1996). Cette alliance se fait aussi remarquer à la 37[e] conférence nationale annuelle de l'*Association for Direct Instruction* (Hyde & Watkins, 2011), ce qui pourrait augmenter la popularité de cette combinaison auprès des enseignants.

En ce qui a trait aux différences retrouvées entre les groupes d'élèves présentant un rendement scolaire faible comparativement aux groupes d'élèves présentant un rendement plus élevé, les études actuelles en Enseignement Direct et en didactique de précision se font rares. Les écrits scientifiques présentent soit des études comprenant des élèves en difficulté d'apprentissage ou atypiques (Winchester et al., 2009) ou des élèves provenant de milieux défavorisés (Crowe, Connor, & Petscher, 2010). Les études actuelles ne présentent pas de comparaisons entre des groupes d'élèves typiques démontrant un faible rendement scolaire vs un rendement plus élevé. Pourtant, les résultats d'une méta-analyse d'Adams et Engelmann (1996) attestent que les élèves ayant un faible rendement scolaire présentent des lacunes quant à ce qui a trait à la compréhension des concepts et des habiletés scolaires en général. Les résultats confirment aussi que les élèves présentant un rendement scolaire plus élevé ont besoin de moins de répétition, moins de révision et d'un nombre moins élevé d'exemples pour comprendre le même matériel que les élèves présentant un rendement plus faible. La pertinence de cette recherche est dans l'intérêt pour les différences retrouvées auprès des élèves typiques présentant un faible rendement scolaire comparativement aux élèves typiques qui présentent un rendement plus élevé, utilisant une combinaison d'enseignement direct et de didactique de précision.

Cette thèse doctorale contient deux articles. Le premier article, *Self-monitoring Intervention and Precision Teaching: An Analytical Listing and Review of the Standard, Alternate, and Computerized Charts*, présente une recension des écrits scientifiques sur l'autogestion des apprentissages, plus précisément sur l'autonotation et l'auto-inscription graphique. Comme plusieurs outils peuvent êtres utilisés pour noter (angl. *to monitor*) les apprentissages, une analyse critique des graphiques développés au cours des années en didactique de précision est présentée pour la première fois à notre connaissance. En effet, aucune analyse critique des graphiques en didactique de précision, incluant les graphiques standards et ceux qui sont dits alternatifs, autant papiers qu'informatisés, n'a été publiée. En outre, un intérêt marqué pour les graphiques informatisés et l'apparition de nouveaux graphiques alternatifs dans le monde de la didactique de précision ravive l'intérêt pour celle-ci et l'auto-inscription graphique (Giroux 1984 ; Giroux & Forget, 1996 ; Regli et al., 2010a, 2010b ; Harder, 1998 ; Péladeau, 2001, 2003 ; Schuessler & Forget, 2009 ; Slocum, 1994 ; Sutherland & Snyder, 2007). Une analyse comparative des caractéristiques des graphiques papiers et informatisés ainsi que les avantages des derniers est réalisée. Cet article sera soumis à la revue *Education and Treatment of Children*.

Le second article, *The Effects of Self-graphing Academic Performance On Reading Fluency Using Precision Teaching: Seventh and Eighth Graders Learning French Phonemes*, présente les résultats d'une étude empirique sur une intervention d'autogestion, plus précisément de l'auto-inscription graphique du rendement scolaire de la lecture de phonèmes francophones à l'aide de l'enseignement direct, de la didactique de précision et des procédures prescrites par ce type d'enseignement. Le premier objectif de recherche vise à examiner les effets de l'auto-inscription graphique régulière et moléculaire des apprentissages de 63 élèves typiques de septième et huitième année dans un cours de français comme langue seconde. L'auto-inscription graphique est notée à l'aide d'un graphique papier alternatif de la didactique de précision, le *Standard Alternate Celeration Chart*, provenant du graphique standard de la didactique de précision, le *Standard Celeration Chart*, graphique couramment utilisé dans ce domaine. Le deuxième objectif de recherche est de comparer les résultats de l'auto-inscription graphique des élèves typiques qui présentent un faible rendement scolaire de ceux qui présentent un rendement scolaire plus élevé. L'étude se veut inductive et utilise des niveaux de base multiples, répartis en fonction des quatre classes de français comme langue seconde. Cet article sera soumis à la revue *Journal of Behavioral Education.*

Après les deux articles constituant le corps de la thèse, la discussion générale porte sur une analyse critique et très détaillée des avantages et désavantages réciproques des différentes configurations des graphiques de la didactique de précision et sur les explications du manque d'intérêt pour cette technique d'évaluation. La discussion expose ensuite l'intégration de l'ensemble des résultats, les contributions et les limites de l'étude, puis offre quelques suggestions pour des recherches futures dans le domaine de la didactique de précision. Puisque la réforme scolaire au Québec, nommé *Renouveau pédagogique* (Ministère de l'Éducation, du Loisir et du Sport, 2005), influence les choix pédagogiques de la province, il se révèle primordial de terminer la discussion générale en évoquant quelques raisons possibles pour expliquer la faible présence des méthodes éducationnelles efficaces.

Mots clés : didactique de précision, enseignement direct, autonotation, auto-inscription graphique, graphique informatisé, graphique alternatif, rendement scolaire

CHAPITRE I

ARTICLE I

Self-monitoring Intervention and Precision Teaching: Analytical Listing and Review of the Standard, Alternate, and Computerized Charts

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The data in this research was also used in a doctoral dissertation.

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Abstract

This literature review aims at creating an inventory of graphs used in the field of education, specifically in the arena of Precision Teaching. The focus is on self-graphing of academic performance and its many advantages like fostering feelings of self-confidence in learners, and increasing academic performance. Although the focus is on Precision Teaching, Direct Instruction and Curriculum-based Measurement are briefly described and reviewed because these teaching methods systematically use graphs in educational settings. Despite the fact that Precision Teaching has been used in education and applied behavior analysis for more than four decades, to this date, a listing of all Precision Teaching charts has never been published. This analytical listing is imperative in allowing both practitioners and researchers concerned with monitoring and modifying academic behaviors to gain knowledge about the different available graphs, and to assess their respective advantages and drawbacks. An interest in using alternate versus standard Precision Teaching charts, and the development of these charts and procedures in a computerized format, also motivated the necessity for such a critical listing and analysis. Finally, the analysis suggests the superiority of computerized charting.

Keywords: Self-monitoring, Self-graphing, Precision Teaching, Standard Celeration Chart, Alternative Chart, Computerized Chart

Self-monitoring Intervention and Precision Teaching: An Analytical Listing and Review of the Standard, Alternate, and Computerized Charts

The *National Reading Panel* (*NRP*; 2000) report stated that the concept of fluency is an imperative component of research-based educational practices. The concept of fluency is defined as speed and accuracy combined when executing a task (Binder, 1996, 2003, 2004; Bloom 1986; Chiesa & Robertson, 2000). The NRP (2000) also recommended the use of explicit teaching methods in education. Explicit teaching methods, such as Direct Instruction, Curriculum-based Measurement (CBM), and Precision Teaching (PT) focus student attention toward specific learning in a highly structured environment (Carnine, Silbert, Kame'enui, & Tarver, 2010; Rosenshine, 1979, 1986, 2009). Nine years later, the *Canadian Language and Literacy Research Network* (2009) published a report confirming the conclusions of the NRP (2000) and also recommended the use of explicit methods in teaching reading and language.

In applied behavior analysis, explicit teaching methods like PT or Direct Instruction have been discussed more frequently in books, book chapters, articles, and congress programs of the Applied Behavior Analysis International in recent years (Calkin, 2005; Calkin et al., 2011; Carnine et al., 2010; Cooper, Heron, & Heward, 2007; Filer & Kozma, 2010; Fredrick, Deitz, Bryceland, & Hummel, 2000; Graf & Lindsley, 2002; Heward, 2008; Kozma, 2011; Lindsley, 2010; Moran & Malott, 2004; Pennypacker, Gutierrez, & Lindsley, 2003; Schuessler & Forget, 2009; Vargas, 2009). However, even though these methods are more frequently discussed, they are still not considered at the core of today's mainstream educational practices. Frequent or continuous assessment of academic performance is an important component of explicit teaching methods. Practitioners in the educational fields like Direct Instruction, PT and CBM reliably make the use of graphs in displaying frequent student academic performance (Calkin, 2005; Deno, 2003; Giroux & Lévesque, 2001; Graf & Lindsley, 2002; Hosp, Hosp, & Howell, 2006; Lindsley, 1971, 1997; White & Haring, 1980).

This literature review aims at creating an inventory of graphs used in the field of education, specifically in the arena of Precision Teaching. The focus is on self-graphing of academic performance. Many advantages of self-graphing have been mentioned in the scientific literature. For example, Lindsley (1990a) mentioned that self-graphing (or self-charting, as preferred in PT) fosters feelings of self-confidence in learners. Rock (2005) noted an increase in academic performance, and Gunter, Miller, Venn, Thomas, and House (2002) and Moxley (2007) showed that students enjoyed self-graphing. This analytical listing of graphs is imperative in allowing both practitioners and researchers interested in monitoring and modifying academic behaviors to be aware of the different available graphs, and to assess their respective advantages and drawbacks. Such an analysis will allow a better focus on the needs of both researchers and practitioners in the development of PT monitoring tools. Moreover, an interest in using alternate versus standard PT charts, and the development of computerized PT charts and procedures, motivated the necessity for such a review of literature. To our knowledge, an analytical listing of all PT charts, including standard and alternative, both paper and computerized, has never been published even though PT has been used in education and applied behavior analysis for more than four decades (Cooper et al., 2007; Fredrick et al., 2000; Giroux, 1976; Graf & Lindsley, 2002; Lindsley, 1971; Vargas, 2009; White, 1986; White & Haring, 1980). Although the focus of this literature review is on PT, Direct Instruction and CBM are briefly described and reviewed because they systematically use graphs in educational settings. However, PT offers a larger range of standard and alternate graphs, both paper and computerized. These graphs will be listed and analyzed in detail.

Self-monitoring

Self-monitoring interventions refer to the skills a person displays autonomously in order to manage his own behaviors in interaction with his environment (DiGangi, Maag, & Rutherford, 1991; Mammolenti, Vollmer, & Smith, 2002). Self-monitoring has been widely used in clinical and educational settings, catching both the attention of researchers and practitioners for more than 20 years with success (DiGangi et al., 1991; Mace & Kratochwill, 1988; Sutherland & Snyder, 2007).

The use of self-monitoring has been documented, for example, in resource classes, self-contained settings with students of varying disabilities, and in general education. Self-monitoring of performance in school settings is defined by students' attention on measuring and recording their academic performance, for example, performance in reading fluency (Mammolenti et al., 2002; Reid & Harris, 1993).

Graphing and Self-graphing

According to numerous authors, graphic display of a students' progress throughout time offers both the student and the teacher a more adequate visual representation of his learning and progress in comparison with the use of a table (Krohn, 1991; Lindsley, 1991; Parsonson, 1999, 2003; Parsonson & Baer, 1978, 1986, 1992; Smith, Best, Stubbs, Archibald, & Roberson-Nay, 2002; Wainer, 1992). Essentially, the student's progress is seen on the chart with each data-point added and the slope illustrates the increase or decrease of a targeted behavior. This renders patterns obvious, allowing inferences to be drawn more easily than a table allows. Furthermore, Moxley (2007) suggested that graphs depict relationships that would be unnoticed in tables and lists, and Glass (2004) stated that results of meta-analyses should always be reported in graphic format as opposed to simply by averages.

Graphing in education shows clear advantages such as clarification of objectives and individualization of instruction (Moxley, 2007). Moxley also suggests that graphing allows for learning of transversal competencies like learning about math concepts of graphs, measurements, and data gathering applied in other courses.

Self-graphing, the activity of students self-recording their behaviors and academic performance on a chart, shows a clear impact on enhancing teacher decision-making (White & Haring, 1980). Many other authors also studied positive effects of self-graphing with students. Some examples include: (a) Swimming in the absence of coach verbalization, (b) computerized data management, (c) improving classroom instruction, (d) students' preparedness, (e) reading performance, (f) reading fluency, (g) written expression, and (h) completion of homework assignments (Critchfield & Vargas, 1991; Gunter, Miller, & Venn, 2003; Gunter et al., 2002; Hylan & Keaton, 1994; Moxley, 1998, 2007; Shimabukuro, Prater, Jenkins, & Edelen-Smith, 1999; Stotz, Itoi, Konrad, & Alber-Morgan, 2008; Sutherland & Snyder, 2007; Trammel, Schloss, & Alper, 1994).

Lindsley (1971, 1990a, 1990b, 2010) also explored self-graphing within the field of Precision Teaching. However, because of the exclusive use of a standard chart, the preferred term in Precision Teaching refers to self-charting rather than self-graphing.

Advantages of self-graphing. Advantages associated more specifically to self-graphing are that it decreases time and responsibilities from teacher to monitor students' work and progress, allowing them to offer more support to students in need, and enhances reactivity to self-monitoring by decreasing unwanted behaviors and increasing academic performance (DiGangi et al., 1991; Gunter et al., 2002; Moxley, 2007; Sutherland & Snyder, 2007). According to Rock (2005), the fact that students are involved in the change process improves their behavioral and academic performance, thus allowing them to exercise choice and showing them how to execute decision-making skills on a daily basis. Lindsley (1990a) stated that students will develop trust by not having the teacher double-checking his counts, and adds that students develop life-long self-monitoring skills that can be applied to many other settings. Students also expressed enthusiasm in graphing their own performance data (Gunter et al., 2002).

Lindsley (1990a, 2010) affirmed that self-charting produces more rapid learning than when the teacher or a student peer does the charting for the learner. Additionally, motivation is increased for teachers when their instructional conditions are improved, as well as for students when they experience improved academic performance (Moxley, 2007).

Educational Practices Using Graphs

A few educational methods like Cumulative Teaching, Data-based Program Modification, 'Exceptional Teaching', Direct Instruction, Curriculum-based Assessment, CBM, and PT share common elements such as (a) continuous students' performance monitoring, (b) elements of recording-plotting, and (c) performance data visual analysis (Binder, 1990; Blankenship, 1985; Blankenship & Lilly, 1981; Carnine et al., 2010; Deno, 1985; Deno & Mirkin, 1977; Hosp & Hosp, 2003; Lindsley, 1991; White & Haring, 1980). Direct Instruction, CBM and PT are more present in the recent literature.

Direct Instruction. Direct Instruction is a highly structured instructional program, teacher-centered, and focusing on teaching to mastery (i.e., performing skills at high levels; Bereiter & Engelmann, 1966; Watkins & Slocum, 2004). Engelmann and colleagues' work generated more than 100 curricula of explicit teaching of reading, writing, language, math, spelling, and science in the primary grades and high school (Carnine et al., 2010). Scientific literature refers to these curricula by using capital letters and calling it *Big DI* (Adams & Engelmann, 1996; Bereiter & Engelmann, 1966; Carnine et al., 2010; Engelmann & Carnine, 1991;

Engelmann, Haddox, & Bruner, 1983; Engelmann, Hanner, & Johnson, 1999a, 1999b; Marchand-Martella, Slocum, & Martella, 2004; Stein, Kinder, Silbert, & Carnine, 2006).

Carnine et al. (2010) examined reading rates of students that performed between the 50th and 75th percentile on standardized tests, and set Direct Instruction reading rates accordingly. A common method of assessing student reading fluency is to use regular one-minute timed passage readings, and to visually display the results on a simple graph paper. Either the teacher or the student will graph the results. However, it is not a prescribed activity to graph results in Direct Instruction. The prescription is to keep a record of performances and to use accuracy percentages in assessing mastery of content in students (Carnine et al., 2010; Lindsley, 2010).

Curriculum-based measurement. Curriculum-based measurement is a variant of curriculum-based assessment and is defined by a general outcome measurement of instructional needs by measuring students' performance tied to a student's curricula and where the measurement procedure mirrors the content of that particular curriculum (Hintze, 2009; Hintze, Christ, & Methe, 2006). Curriculum-based assessment is mostly used when the primary task of assessment is to establish the comfort-level of instruction and independence-level of students within the curriculum content, but does not keep track of students' performance with a long-term goal in mind. On the other hand, CBM focuses on students' long-term goals and evaluation procedures based on research insuring psychometric and edumetric adequacy (Fuchs & Deno, 1991; Fuchs, Deno, & Mirkin, 1984; Fuchs & Fuchs, 1986, 1990).

Curriculum-based measurement uses frequent timed (1-5 minutes) measures of students' performance and graphic displays of it over a calendar base (see Figure 1) for recording and decision-making about basic academic skills (Binder, 1990; Deno, 2003; Hintze, 2009; Hintze et al., 2006; Shinn, 1989, 2001). The term fluency is also used within the theoretical frame of CBM (Deno, 1985; Fuchs et al., 1984; Hintze, 2009; Hintze et al., 2006). Marston and Magnusson (1985) claim to have used class averages to set aims rather than objective performance standards with CBM. However, Fuchs and others (1984) have used standardized tests in their study (i.e., *Stanford Diagnostic Reading Test*) in order to set fluency goals and assess students' reading performance, and Deno, Fuchs, Marston, and Shin (2001) conducted a study on using CBM to establish growth standards for students.

Precision Teaching. Precision Teaching is a general approach to verifying if a teaching method is reaching its goals (Chiesa & Robertson, 2000), and a universal criterion-reference evaluation system (Lindsley, 1972). Lindsley created PT in 1965 in order to help children in special education classes in the *Children's Rehabilitation Unit* of the *Kansas' University Medical Center* (Lindsley, 1990a, 1990b, 1991, 2010). This procedure allows practitioners to assess all types of observable and measurable behaviors (academic, personal, motor, linguistic, affective, etc.) and can be combined with any curriculum and any teaching method (Giroux & Lévesque, 2001; Lindsley, 1971, 1997; West & Young, 1992; White, 1986; White & Haring, 1980). Precision

Teaching is proposed as a simple and permanent verification method of learning behaviors. It allows for regular data collection where self-monitoring can be at the core of the procedure, from a yearly, monthly, weekly to a daily charting procedure (Lindsley, 1972, 1992, 2010). Teachers can use the scores and slopes (regression line; White, 2011) to identify discrepancies in performance levels between a student and the peer group to help inform decisions about, for example, the need for special services or establishing reintegration of a student in a regular classroom (Kubina, 2005).

A large number of empirical studies show the use of PT in many different contexts and clienteles. Precision Teaching was used in school learning (Fitzgerald & Garcia, 2006; Giroux & Forget, 1996; Spence, 2002; Sulgrove & McLaughlin, 2004; White, 2002), in behavior modification and social skills training (Lovett, 2004; Mason, 1985; Schuessler & Forget, 2009; Smyth & Hardy, 2002; Zambolin, Fabrizio, & Isley, 2004), and for other learning situations like playing piano (Calkin, 2002b), learning Russian (Calkin, 1996), improving golf performance (McDowell, McIntyre, Bones, & Keenan, 2002), running performance (McGreevy, 1984), or ballet dancing (Lokke, Lokke, & Arntzen, 2008). Precision Teaching is also used to note and record some very specific reactions like frequency of fetal movements (Calkin, 1983), the frequency of obtaining a degree related to school funding (Stephens, 2004), or frequency of an author's publications (Commons, 2003).

The *Journal of Precision Teaching and Celeration* is the official journal of Precision Teaching. Although it can be found on *Google Scholar*, it is not found in any of the academic databases such as *EBSCOhost*, *JSTOR*, psycARTICLES, and *PubMed Central CA*. Only nine articles were found on *ERIC*. It is a possibility that PT is not well known in the scientific circles because it came from an oral tradition. Precision Teaching was developed mainly in public school classrooms, and information about PT disseminated through teachers' workshops (Lindsley, 2010). Trained specialists were reinforced on the number of presentations and training sessions instead of being encouraged on the number of written publications. The specialists were trained as practitioners rather than researchers. According to Lindsley, this explains the ratio of 3:1 oral communications for every publication. By not publishing profusely in periodicals, PT was not well publicized and its use stayed among the already convinced.

Precision Teaching has an official group, *Standard Celeration Society*, and associated website (http://www.celeration.org/). A useful website has also been created to offer a vast amount of information regarding all aspects of PT and is being updated regularly by Claypool-Frey (2010; http://precisionteaching.pbworks.com/). Many schools and learning centers use PT procedures, for example, *Ben Bronze Academy/The learning Incentive, Inc.* (West Hartford, CT, www.learningincentive.com); *Judge Rotenberg Center* (Canton, MA, http://www.judgerc.org/); *QLC Educational Services* (Belleville, Ontario Canada, www.teachyourchildrenwell.ca), among many others.

Precision Teaching Paper Charts

Different charts answer the need for both researchers and practitioners to gather and analyze data in Precision Teaching. The uniqueness of the PT charts, in comparison to other charts, lay basically in the technicalities of their semi-logarithmic axes. The progress is assessed through celerations (Lindsley, 2010). The most commonly used chart found in the literature in the field of PT is the *Daily Standard Celeration Chart* (i.e., daily SCC; Calkin, 2005). However, Calkin suggests using the *Weekly Chart* for all infrequent behaviors, for example, behaviors that only occurs three-four times per day.

Standard celeration chart. The *Standard Celeration Chart (SCC)* is the official Chart recognized and used by practitioners in the field of Precision Teaching (Lindsley, 2010). It is also the only chart published in the *Journal of Precision Teaching and Celeration*. The SCC is a semi-logarithmic chart. It is formed of six superimposed cycles, each of a multiple of 10 on the logarithmic ordinate, and calendar days on the arithmetic abscissa, respecting a 34-degree angle. This 34-degree angle allows a diagonal left-bottom-corner to right-upper-corner slope to represent doubling in frequency every seven days on the successive calendar days on the abscissa (see Figure 2). An additive scale on the ordinate would not represent accurately the ratio between performances obtained at different times. An illustrative example of the property to translate raw changes into proportioned changes in learning frequencies is a student progressing from 50 *corrects* (i.e., words read correctly) per minute to 100 corrects per minute, compared to another student increasing from 100 corrects per minute to 200 corrects per minute. Both students double their frequencies in reading and the proportion is respected between the two students. If the same students read five more words per minute (i.e., increasing from 100 to 150 corrects per minute and 200 to 250 corrects per minute respectively), the first student has a gain that is more significant (50%) than the second student (25%; Baer & Parsonson, 1981; Giroux, 2010; Lindsley, 2010; Pennypacker et al., 2003; West & Young, 1992).

The term *standard* is used in reference to the respect of that 34-degree angle on all charts, rendering data-sharing simple among users and guarding against visual artifacts caused by a mismatch of unequal and variable graph axes in the representation of the changes obtained by learning (Lindsley, 2010). Graphically, the chart has a large range of frequencies–from one behavior every 24 hours to 1000 behaviors per minute. The SCC, on the landscape view of a paper format of 81/2 by 11 inches containing 140 days (half of a school year) on one page, was specifically designed to fit on overhead projectors and computer display screens (Giroux & Forget, 1996; Giroux & Lévesque, 2001; Lindsley, 1991; White, 2011; White & Haring, 1980). Although the daily SCC is the most popular SCC chart used in educational settings, there is also a weekly, monthly, and yearly SCC (Pennypacker et al., 2003). Using behavior frequencies, charting is based on one-minute *timings* (i.e., one-minute timed reading periods), where a ratio of corrects and errors per minute are inscribed in order to monitor progress within an individual or group of individuals (Lindsley, 1972; Giroux & Lévesque, 2001). The progress of individuals is interpreted as *celeration*, a root word for acceleration (i.e., an increase in frequency) and deceleration (i.e., a decrease in frequency; White, 2011). In some instances, two-minute timings are granted to learners to get extra time to cover material of longer length (Kubina, 2005). The opposite is also done with shorter timings (30-second and 15-second timings) in order to change the celeration coefficients of struggling students by offering shorter but more frequent timed readings (Kubina, 2005; Sroka, 1990). Interestingly, although charts based on hours (hourly), minutes (minutely chart), seconds (secondly chart), and some in-between charts were created, the interest or use for those charts was relatively low and were not manufactured (Lindsley, 1999). However, it is a current practice in PT (and in Direct Instruction and CBM, for example) to use one-minute timings because it seems pragmatic and instrumentalist (e.g., no computation is needed to convert numbers into rates; Binder, 1990; Calkin, 2005; Carnine et al., 2010; Deno, 2003; Giroux & Lévesque, 2001; Lindsley, 1971, 1991, 1997, 2010; Vargas, 2009; White, 1986; White & Haring, 1980). Even if it is considered practical, it can be argued that using a one-minute timing is neither a justification nor a representation of mastering a certain skill or task.

Beck, Conrad and Gayler (1994) commercialized a chart based on the SCC, but much larger in size: 24 inches by 36 inches. The poster-chart offers quite an advantage concerning the visual impact of celeration lines. However, it is not a format that can be easily carried and stored. Although, its large format certainly was interesting for congress' poster sessions or during conferences, its use in classrooms was limited, perhaps due to students' grades being considered confidential material (Daggett & Huefner, 2001). Berquam (see Vargas, 2009) designed a *Simplified Chart* for one-minute (or less) timings. The *Simplified Chart* displays nine weeks, the same 34-degree angle, although is back to its original paper format of 81/2 x 11 inches. In order to render the SCC easier to use, Berquam expanded the space between the lines, and only showcased the upper half of the SCC. Although Vargas (2009) maintains that teachers prefer the SCC, and that the students find it easier to chart with the simplified version, no empirical data is mentioned.

Beck, Conrad, and Anderson (1999) created a booklet of practice sheets and three-cycle charts with a count of 1-1000 behaviors per minute per day, for a total of 70 days. *Basic Skill Builders Academic Charts: One-minute Fluency Builders Series*, is sold though Sopris West Educational Services. This type of chart was also called the *Timings Chart*, a similar chart to the SCC, but with an abscissa serving only per timings rather than following a school calendar.

Some criticisms were raised about the SCC visual display: teachers find it difficult to read the chart due to its condensed scale (Giroux & Forget, 1996). Although the SCC is the most popular chart in PT to date, there are other alternative charts sharing similar characteristics and Giroux and Forget suggest such alternative charts.

Giroux and Forget's four alternative charts. Giroux and Forget (1996) created four charts (i.e., *Modules A* to *D*) to answer the need for more conviviality of usage of the chart in the classroom. Conviviality of the chart is characterized here by its attractive visual appearance and user-friendly procedures. The charts put on the vertical side of an 8 1/2 by 14 inches paper sheet format, while displaying only four weeks, magnify visual aspects of the slopes while still respecting the same 34-degree angle of the *Standard Celeration Chart.* Two of theses charts target academic performance while the two others target acquisition of appropriate personal/social behaviors. The frequency spans of the two charts targeting academic performance are: *Module A* (see Figure 3), from 5 behaviors per minute to 1000 behaviors per minute, and *Module B* (see Figure 4) from one to 200 behaviors per minute.

Giroux and Forget (1996) mention the teachers' preference for using the alternative charts rather than the SCC, and even if limited, the use of the alternative charts has been maintained throughout time. In contrast, the use of the SCC has been dropped in preference for the alternative charts. In 2000, *Module A* and *B* were combined together in order to create another chart, the *Standard Alternate Celeration Chart* (see Figure 5).

The standard alternate celeration chart. Created by Giroux and Crow (2000), the *Standard Alternate Celeration Chart (SACC)* has a frequency span expending from 0 to 500 behaviors per minute on the same chart instead of using the *Module A* (span from 5 to 1000 behaviors per minute) or *Module B* (span from 1 to 200 behaviors per minute; Giroux & Forget, 1996; Giroux & Lévesque, 2001). This new frequency span integrated on one chart allows for the measurement of oral reading with low performing students (low frequencies) as much as with more experienced readers (high frequencies) all in the same regular classroom. It is the first time that a PT chart starts with a zero, the standard chart SCC adopting other rules (see White & Haring, 1980, for more details). This "zero" was integrated into the alternative chart SACC because students requested it repeatedly; the zero represents the absence of behavior (e.g., absence of error). However, the added value of zero has a downside: it does not allow for an in-depth examination of low occurrence behaviors. On the standard SCC, the frequency scale allows to observe behavior occurring from .001 behaviors per minute (i.e., one behavior par day), while the zero on the SACC does not allow an analysis under one behavior per minute.

The alternative chart SACC added instructions on charting procedures in the margin and a choice of timings of 15, 20, 30 seconds or one minute. Finally, the return of 8 1/2 by 11 inch paper format (instead of the new 8 1/2 by 14 inch) makes the alternative chart SACC a practical tool by allowing for its easy insertion into a binder or a notebook.

Precision Teaching Computerized Charts

An interest for computerized charts has been mentioned in research (Giroux, 1984; Giroux & Forget, 1996; Schuessler & Forget, 2009; Slocum, 1994) in order to facilitate the use and reduce the time spent by teachers and students in graphing and self-graphing. Edinger (2001) computerized the standard chart SCC in 1971, and again in 1974-1975 projects. Then in 1984, Giroux was an innovator by being the first author to introduce a procedure on how to use PT with MacIntosh computers. The use of computerized charting is also a major asset when it comes to gathering, analyzing, and sharing data for research purposes.

Excel-based standard celeration charts. Harder (1998) used Excel software as a template to execute the standard chart SCC on computers and therefore created the *Electronic-based Standard Celeration Chart*. This alternative chart displays the same basic characteristics of the standard chart SCC, but with computerized procedures. No novelty was added to the chart itself.

Judge Rotenberg center exclusive celeration chart. Péladeau (2001) created an exclusive electronic alternative PT chart for the *Judge Rotenberg Center* (website: http://www.judgerc.org/) displaying daily, weekly, monthly and yearly charts recording frequencies of behaviors or academic performance. Schuessler and Forget (2009) conducted a study on computerized self-graphing. They used a francophone adaptation of the *Judge Rotenberg Center Exclusive Celeration Chart* (Péladeau, 2003) with children with autism spectrum disorders and their special-ed teachers.

Electronic modified standard daily chart. Regli, Giroux, and Frenette (2010a, 2010b) created the *Electronic Modified Standard Daily Chart (EMSDC*; see Figure 6), a practical electronic chart respecting all standard features of the standard chart SCC (e.g., the semi-logarithmic scale and the 34-degree angle). Although no weekly, monthly, or yearly charts are offered, an interesting characteristic of the alternative computerized chart EMSDC is the possibility to enlarge some parts of the charts to magnify the visual impact of an intervention while keeping the 34-degree angle stable at all time. A useful feature of the EMSDC is the minimal celeration line that can be determined by the user, in order to offer guidelines for any intervention with learners.

Statistical Analyses are performed automatically and conveniently displayed directly on the chart. These analyses are: (a) *performance* (i.e., the mean frequency of behaviors per minute); (b) *accuracy* (i.e., the mean frequency of correct behaviors divided by mean frequency of corrects and errors, multiplied by 100 for a conversion into percentage); (c) *Celeration* (i.e., the best-fit line through a set of data-points to indicate the amount of change, either an acceleration or a deceleration); and (d) *Global Improvement Index* (i.e., a summary of the residual variance expressed with a percentage). This last statistic, the Global Improvement Index, is only offered by contemporary Precision Teaching statistical analyses (Giroux & Forget, 1996; Giroux & Lévesque, 2001). It was part of the effort in rendering more user-friendly the PT charts by offering percentages instead ratio in the interpretation of the learner's progress. Once computed, theses analyses are protected from being modified. Visually appealing and user-friendly, the EMSDC should be the object of more research in clinical and educational settings. So far, the EMSDC only works for PC users (website: www.cocon.ca).

Sutherland and Snyder (2007) conducted a study on computerized self-graphing using the weekly CBM assessments. The students entered data on an Excel spreadsheet and embedded graph on the computer, confirming the interest for computerized self-graphing.

Interest in Charts: Standard Versus Alternate

One of the main reasons the standard chart SCC was created was to allow easy chart-sharing between any professional in any field (Lindsley, 1972, 1990a, 1991). This unique chart was to remove time spent on explaining individual scales and particularities of charts while sharing results with colleagues. The standard chart SCC has established a solid reputation in the field of PT and alternative charts are fairly new compared to the original work of Lindsley (1964). In fact, as of year 2000, it was estimated that 1,197,198 standard chart SCC had been used in PT (Calkin, 2002a). These many reasons might explain why alternative Precision Teaching charts have been less utilized in research and publication.

They are several reasons for which practitioners and researchers in the PT field favor the SCC. These include the visual display of behaviors across long periods of time, correlations across behaviors, condition lines, and the ease of finding on the chart the school day along the abscissa standardized with the regular school year calendar (Born, 2001). However, Born (2008), addressing the SCC and the reasons of its existence on the SC*listserv* came to the conclusion that users of the SCC have to spend some time using the tool and its standard procedures before claiming that it has to be modified. This shows to a degree how much resistance there is in using alternative PT charts in the Precision Teaching community. Moreover, he questions the authority to name such alternative charts. In a response to his questioning, Shewmaker (2008) wrote on the SC*listserv*: "Who has the right to name what those charts are, Scott wants to know, and what should that name be? This is a problem of nomenclature and classification, as well as defining the authority to speak with some degree of conclusiveness." The underlying message of the author suggests a malaise deeper than a simple question of nomenclature; it refers to the change, the evolution of the *standard* established in PT for so many years. Resistance lies in the practice–using the standard chart SCC or alternative charts–and in the reluctance to share a common and similar name with charts other than the *Standard Celeration Chart.*

The malaise and dissatisfaction regarding any modification to the SCC is also palpable in the message sent on the SC*listserv* by Verplanck (1998), where he stated that to change a standard form of communication like the SCC without (a) the chart being defective, (b) the change producing an important modification, (c) the chart moving away from its original form, and (d) the chart being accepted and utilized by all, could be rather unsettling for the PT community. Furthermore, Verplanck did not consider propositions on the SC*listserv* to be clear examples of alternative to the *Standard Celeration Chart.*

However, contrary to Verplanck's (1998) viewpoint, all modifications proposed seem to be clear examples of alternatives to the SCC. The alternatives are concerned with the lack of conviviality of the SCC, for example, rendering the chart and its procedures easier to use and offering a choice of shorter frequency spans to make the chart more visually appealing. In fact, teachers have complained about the lack of conviviality of the SCC in the classroom and maintenance of usage was low among that clientele (Giroux & Forget, 1996). So, instead of stepping away from

Precision Teaching, alternative PT charts try to contribute to the evolution of a powerful instrument while still respecting the main components of PT standards applied to SCC, for example, the semi-logarithmic scale and the 34-degree angle (Giroux, 2010; Giroux & Forget, 1996). Interestingly, alternative charts seem to serve as stepping-stones for the use of the standard chart SCC, as Born (2001) commented on the user-friendliness of the alternative SACC compared to the standard SCC. The author announces that he would implement it with children who do not understand the motivational variables and technical aspects of the *Standard Celeration Chart.*

Although the main alternative charts on the market may provide a magnified image of the celerations, a downside to these charts is that they necessitate more space to display the whole intervention compared to the standard SCC. Multiple pages are needed for the alternative charts *Modules A* to *D* and the SACC to illustrate the progression of a behavior that is measured over a period of more than four weeks, and somehow the visual progression is lost compared to the results seen on the one-pager SCC. This problem disrupts the visual analysis of a behavior for practitioners and researchers, and is cost-inefficient for publishers. Perhaps computerized charts could be the answer to both magnified celerations and simplicity of analyses of a larger range of rates among one behavior?

Paper Versus Computerized Charts: An Examination

PT computerized charts were created in order to facilitate the collection, safeguarding, and sharing of data. Automatization of graphing and of calculation of statistical analyses not only renders PT more accessible for any user, but also cuts in charting time of practitioners and researchers when applied to multiple learners. Although the computerized charts offer these great advantages, they were criticized for not consistently offering a stable angle when printing the charts depending on the use of different computers or software (Calkin, 2004). However, the problem of the stability of the 34-degree angle has been neither reported, nor observed on the alternative computerized chart EMSDC (cf. Regli et al., 2010a). Furthermore, no other publication has addressed this issue.

Inspection of Table 1 reveals a comparative outlook on paper versus computerized PT charts. One can scrutinize the characteristics of all charts in determining the advantages and drawbacks related to both charting products and procedures. The observed characteristics are: offered options, statistical analyses, sharing of information, record keeping of raw data for research purposes, chart handling and storage, eco-friendly environment options, and personalization of the charts. Not all computerized charts offer the same advantages and options; however, the comparative table suggests the superiority of computerized charting practices on all aspects and adds between parentheses the specific examples of charts where the specification applies. For instance, computerized charting through *Judge Rotenberg Center Exclusive Celeration Chart* offers the option to transfer data into different charts–from daily, to weekly, to monthly, to yearly. With the EMSDC, some parts of the charts can be magnified for better viewing without any distortion to the 34-degree angle of the chart. All computerized charts offer recording of data, automatic reliable statistical analyses and graphing, and require less training time to apply the procedures compared to the paper charts. The user does not have to learn to compute any statistical analysis, but rather must learn to click on the right key for the software to compute the analyses automatically. Yet, the EMSDC performs the statistical analyses automatically, with only one click of a key. Additional statistical analyses (i.e., the Minimal Celeration Line and the Global Improvement Index) are also available on the EMSDC. The computerized charts all offer (a) easy sharing through Internet, (b) easy insertion in any document, and (c) easy printing without worrying about handwriting skills and proper handling for neatness of the charts. Computerized charts can last longer by requiring less handling, and can be saved on computers and small electronic devices, requiring less space than paper charts. For the environmentally-conscious PT practitioner, the computerized charts definitely offer to use less paper and ink than required by using paper charts. The one advantage that paper charts have on computerized charts is the possibility to draw and write notes and scribbles on the charts, which is not an option offered by any of the available computerized chart.

Conclusion

Charts in Precision Teaching are like radiographs for the medical science; both tools serve the purposes of diagnosing and progress monitoring. Despite self-graphing advantages noted by many authors (DiGangi et al., 1991; Gunter et al., 2002; Lindsley, 1990a, 2010; Moxley, 2007; Rock, 2005; Sutherland & Snyder, 2007) the fact remains that teachers move away from PT procedures after a few weeks, even when the procedures are computerized (Giroux & Forget, 1996; Schuessler & Forget, 2009). Hopefully, the attractive visual appearance and the user-friendliness of the procedures of the computerized charts, especially with the new one on the market, the EMSDC (Regli et al., 2010a, 2010b), might renew the interest for maintenance of use of the Precision Teaching assessing and monitoring tools over time. Furthermore, the acknowledgment of all charts by the charting community, standard and alternatives, should give a better opportunity to conduct more in-depth research to improve the use and maintenance of use of all Precision Teaching charts, and offer new perspectives on self-graphing.

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Table 1

Paper versus computerized Precision Teaching charts: An examination

Characteristics	Charts: Paper (SCC, Simplified Chart, Giroux & Forget's Module A and Module B, SACC)	Charts: Computerized (EBSCC, JRCECC, EMSDC)
Options	To transfer data from one chart to another: must re-plot the dots by hand	Easily transferable data into different charts-from weekly to monthly to yearly-etc. (JRCECC) Viewing format can be changed by magnifying some parts of the charts (EMSDC)
Statistical Analyses	Statistics and graphing done by hand: Requires more training time to apply procedures Requires more time to perform the statistics Can lead to errors in calculations	Automatic statistic calculations and graphing: Requires less training time to apply procedures Almost no time to perform statistics Assures reliability in the analysis of data Additional statistics offered: minimal *celeration* line, and Global Improvement Index (EMSDC)
Sharing of Information	Requires scanning of document in order to share via electronic media Relies on the quality of the charter's handwriting and proper handling of the charts	Easy sharing through Internet Easy insertion in any documents Easy printing
Raw data: Research	Need to use an additional document (score sheet) to keep raw data on record	Raw data recorded in the program
Chart Handling & Storage	Easily damageable More space to store all charts	Charts on computer last longer - less "handling" Charts saved on computers and small electronic devices
Environment	Systematic use of paper and ink	Eco-friendly - less paper, less ink, etc.
Personalization	Can write notes and drawings	n/a

Note. Between parentheses are written the charts that offer specific functions when only found in these unique cases. EBSCC = Excel-based Standard Celeration Chart; EMSDC = Electronic Modified Standard Daily Chart; JRCECC = Judge Rotenberg Center Exclusive Celeration Chart; SACC = Standard Alternate Celeration Chart; SCC = Standard Celeration Chart.

Figure 1. Curriculum-based Measurement chart.

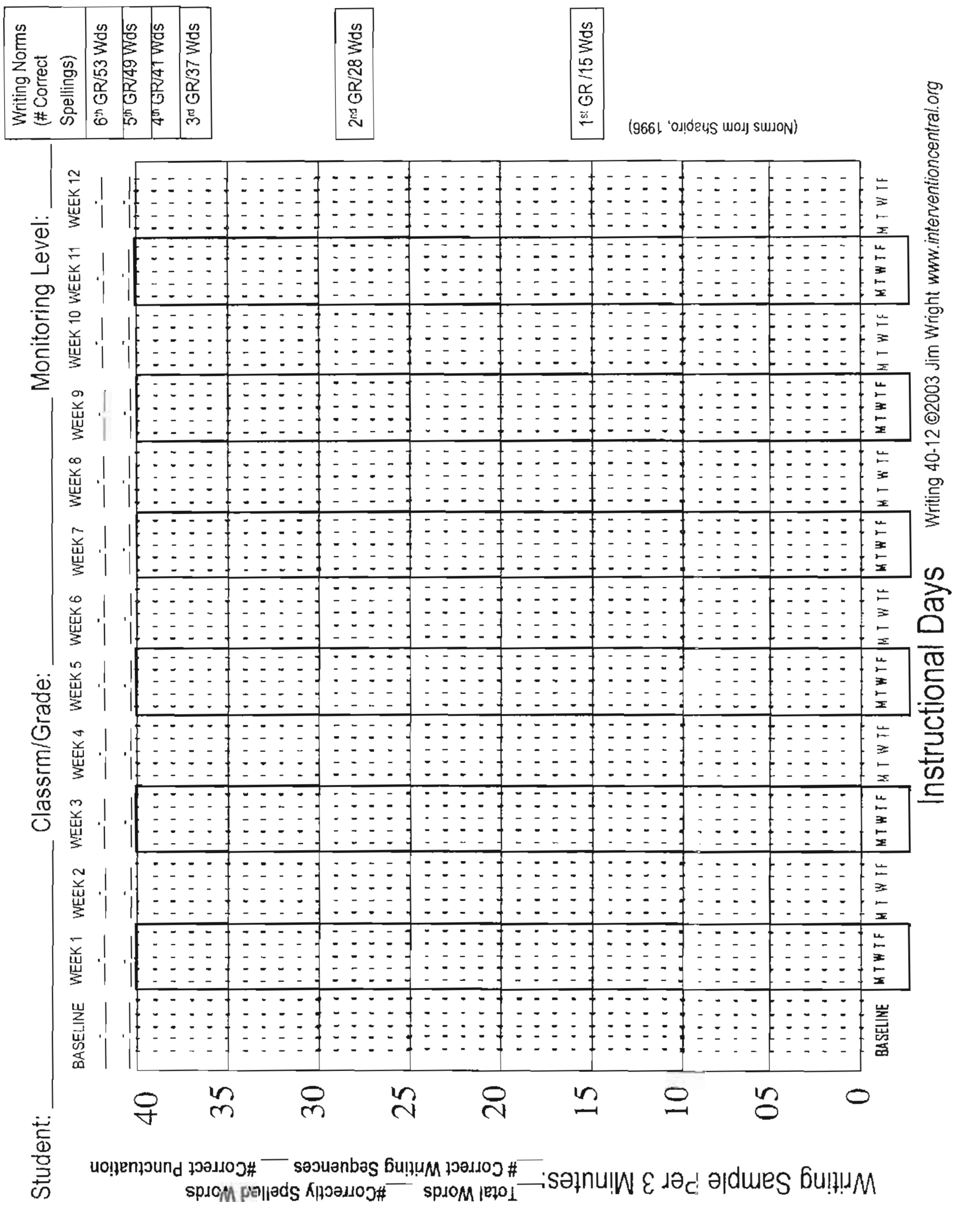


Figure 2. Standard Celeration Chart (SCC).

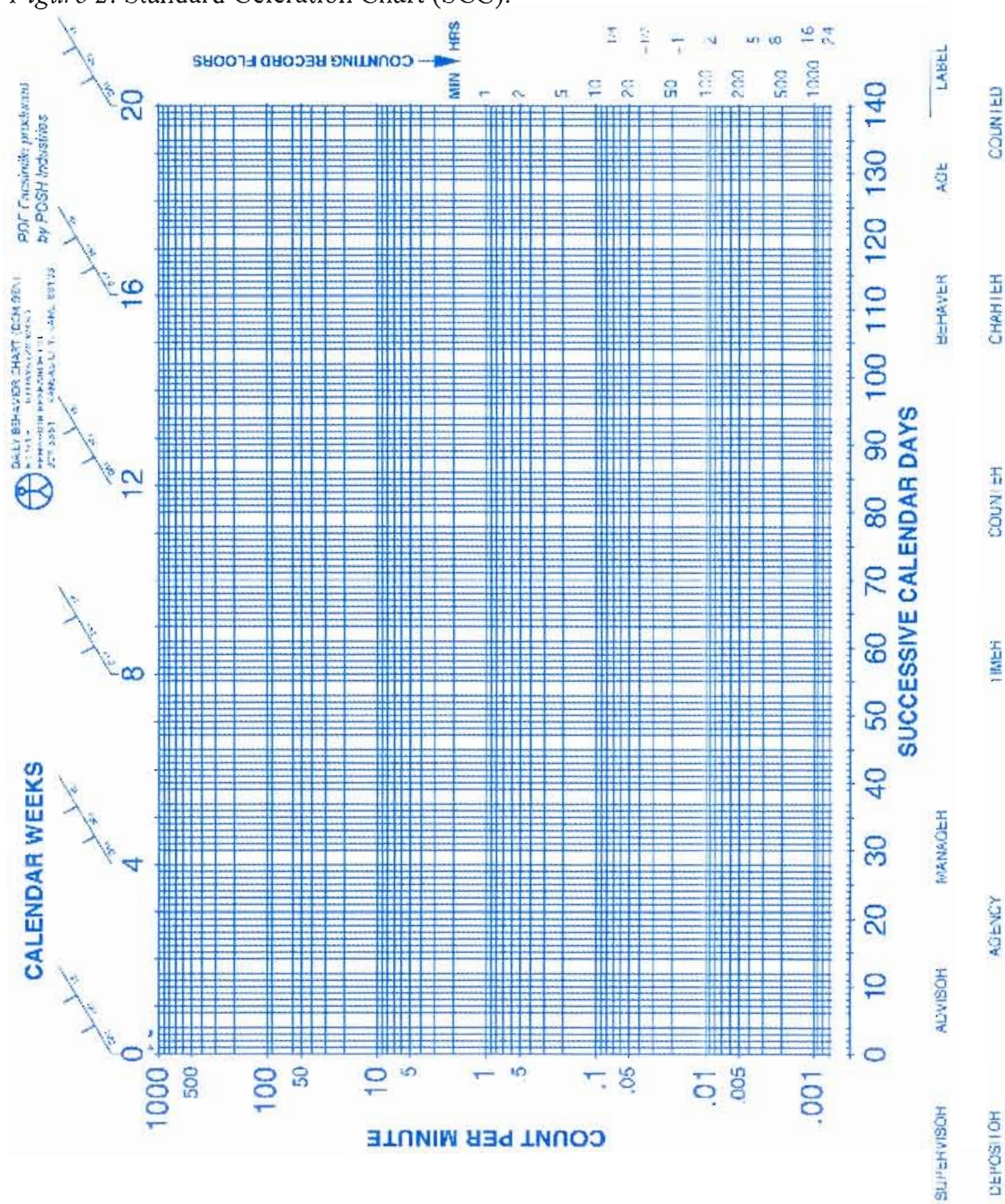


Figure 3. Module A.

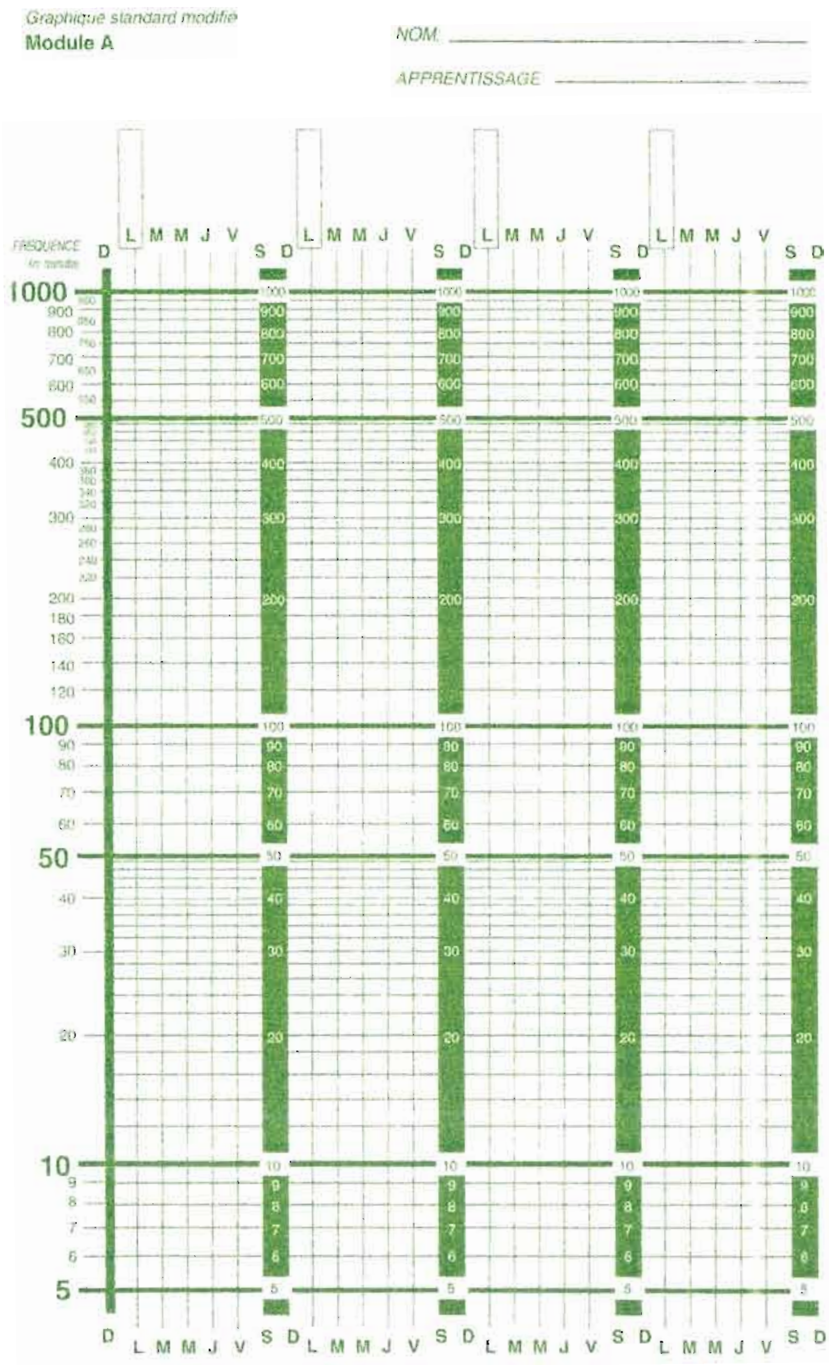


Figure 4. Module B.

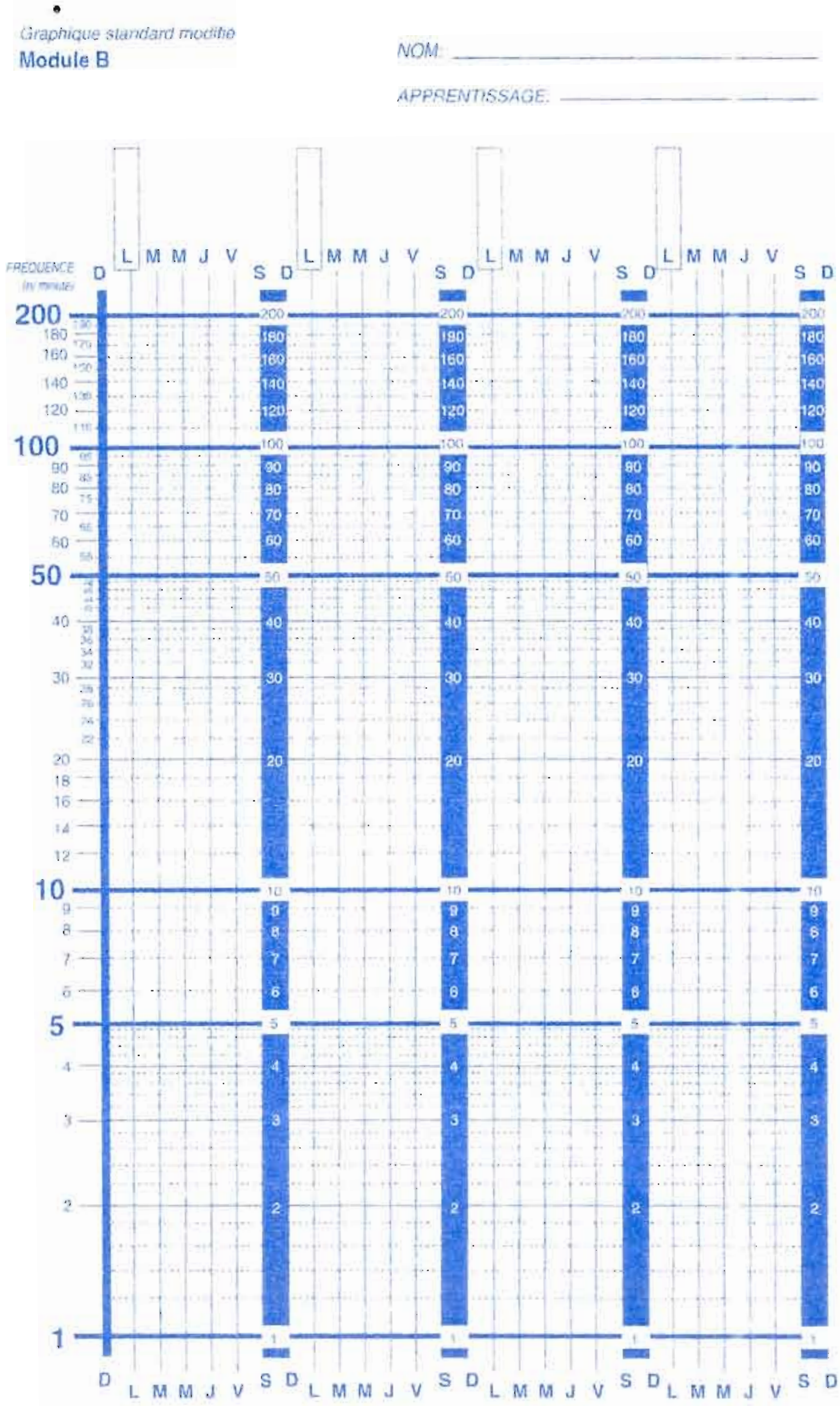


Figure 5. Standard Alternate Celeration Chart (SACC).

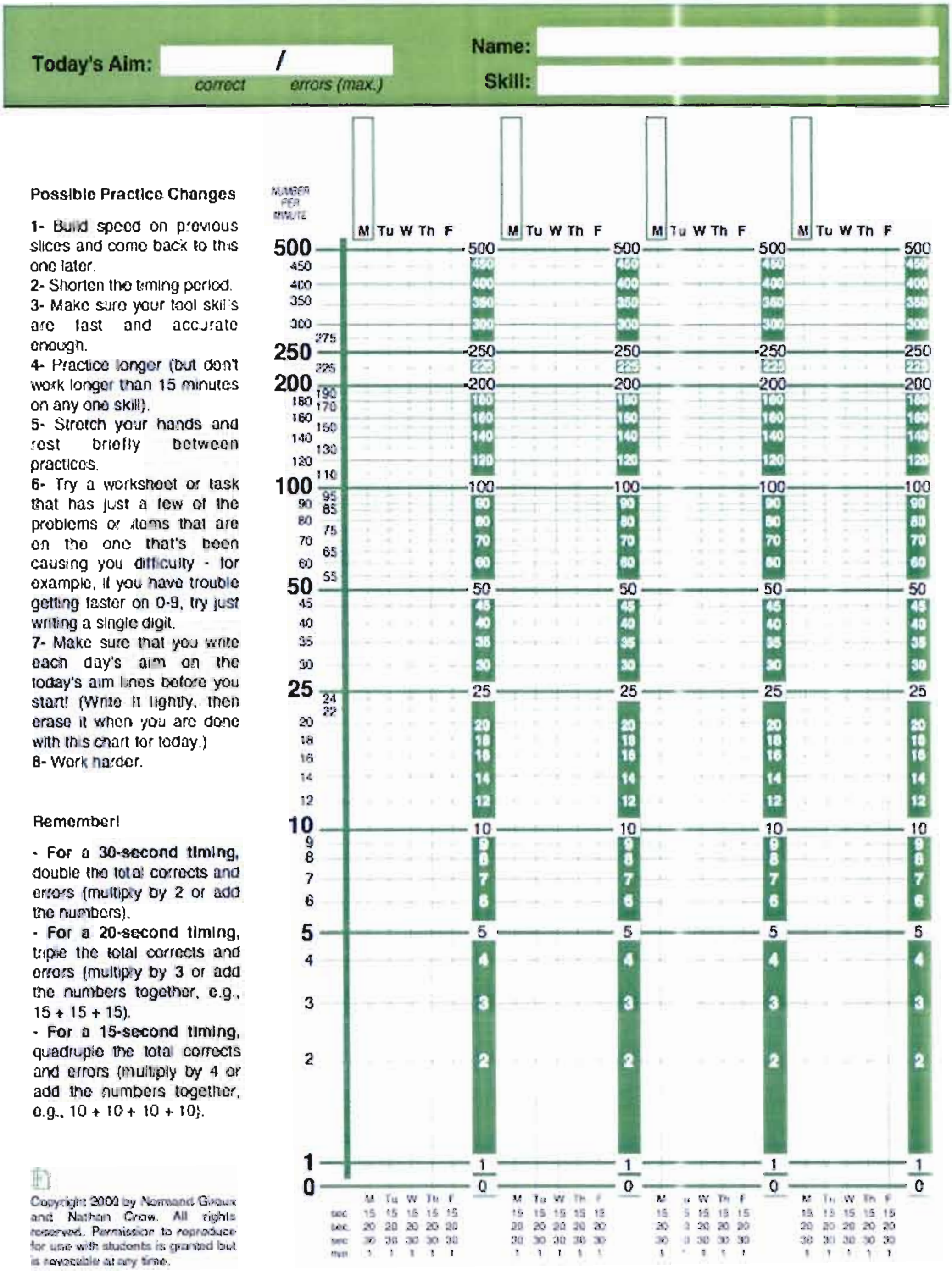
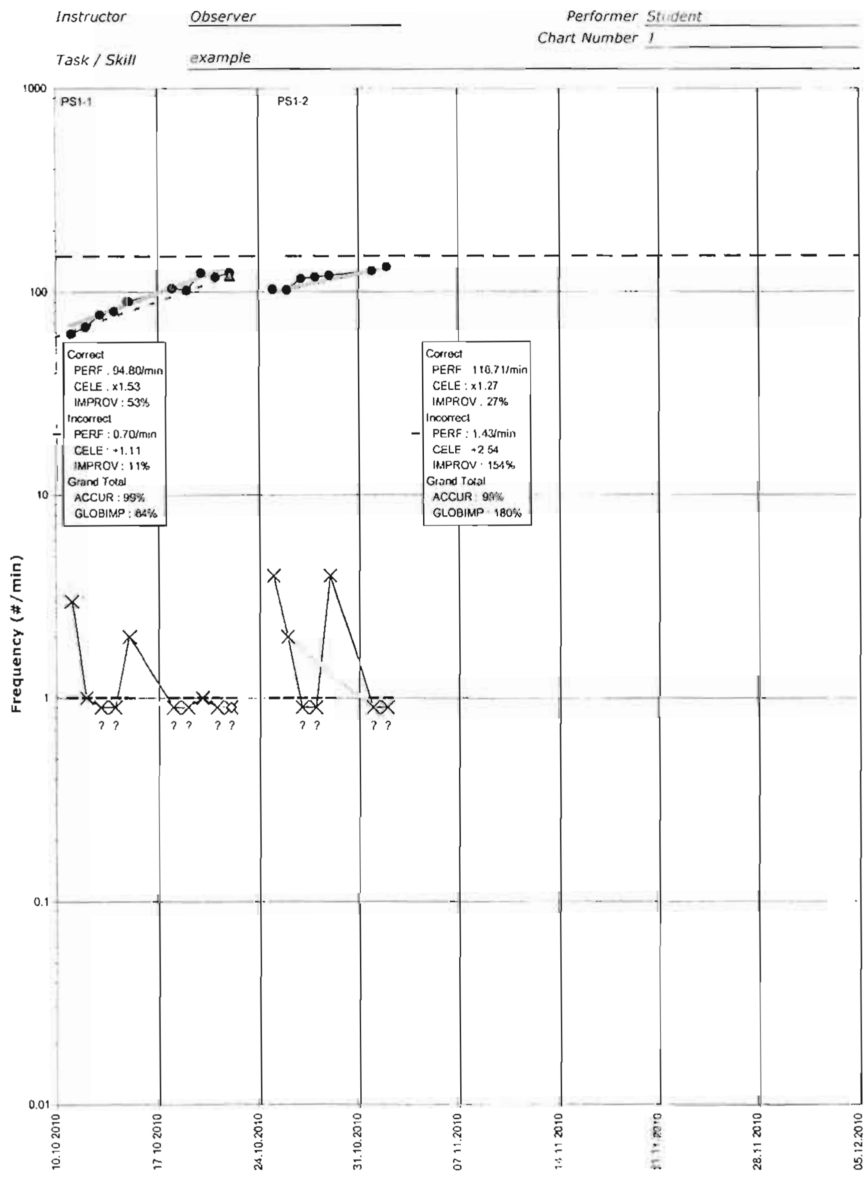


Figure 6. Electronic Modified Standard Daily Chart (EMSDC).



CHAPITRE II

ARTICLE 2

The Effects of Self-graphing Academic Performance On Reading Fluency Using Precision Teaching: Seventh and Eighth Graders Learning French Phonemes

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The data in this research was also used in a doctoral dissertation.

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Abstract

This study focuses on the effects of self-graphing on the academic performance of reading fluency of French phonemes with Precision Teaching, using the *Standard Alternate Celeration Chart*. Sixty-three 7^{th} and 8^{th} graders enrolled in a French as a second language course, divided in four multiple-baseline classes, graphed their reading rates. Research objectives were to examine the effects of self-graphing reading fluency of French phonemes by typical students, and to discern whether self-graphing reading fluency of French phonemes on the same chart had a different impact for typical low and high achievers. Although Precision Teaching statistical analyses (i.e., linear regression called *celerations*) showed no treatment effect, classic statistical analyses (i.e., ANOVA and simple effects) showed that students read French phonemes significantly more fluently at treatment than at baseline. In other words, self-graphing on the *Standard Alternate Celeration Chart* showed a positive general effect on students' reading performance means, but not on celerations. Explanations are offered in the discussion section. Comparisons of the two achieving-level groups were consistent with results found in the scientific literature; performance means were lower at baseline and treatment for the low achieving students than for the higher achieving students. However, when comparing academic gains for both achieving-level groups, the academic gain was of more than twice the amount for low achievers than for the higher achievers, suggesting this group benefited from a highly structured educational practice like Precision Teaching.

Keywords: Self-monitoring, Self-graphing, Precision Teaching, Standard Alternate Celeration Chart, Reading fluency, direct instruction

The Effects of Self-graphing Academic Performance On Reading Fluency Using Precision Teaching: Seventh and Eighth Graders Learning French Phonemes

Whole language, a teaching method based on the recognition of words rather than on the decoding of them, dominated educational practices for numerous years and was at the core of many educational reforms (Goodman, 1986; Smith, 1971, 1979, 1982). During the golden years of whole language, the same authors rejected the teaching of decoding skills as an effective educational practice in the teaching of reading. However, other authors adopted a scientific perspective on the teaching of reading: the bottom-up approach of reading development (Carnine, Silbert, Kame'enui, & Tarver, 2010; Fuchs, Fuchs, Hosp, & Jenkins, 2001; LaBerge & Samuels, 1974; Marchand-Martella, Slocum, & Martella, 2004; Mercer & Mercer, 2004; Rosenshine, 1979, 1986, 2009). The bottom-up approach is based on direct and explicit teaching, hierarchical steps, and mastery learning in the teaching of reading. The higher level processes awaiting the completion of lower ones define mastery learning.

An example of such an explicit teaching method is Direct Instruction (DI)–with capital letters–representing a specific research-based set of curricula developed by Engelmann and colleagues (Adams & Engelmann, 1996; Bereiter & Engelmann, 1966; Carnine et al., 2010; Engelmann & Carnine, 1991; Engelmann, Haddox, & Bruner, 1983; Engelmann, Hanner, & Johnson, 1999a, 1999b). Direct Instruction uses a teaching method promoting an efficient and explicit teacher-directed format. Scripted lessons and faultless communication between teacher and students (e.g., by using examples and non examples to obtain only one interpretation), and the promotion of the importance of mastering basic reading skills to pass on to abilities of higher levels are all strengths and core characteristics of Direct Instruction (Adams & Engelmann, 1996; Bissonnette, Richard, & Gauthier, 2006; Carnine et al., 2010; Ellis, 2001; Engelmann & Carnine, 1991; Marchand-Martella et al., 2004; Péladeau & Legault, 2001).

According to both the *National Reading Panel* (NRP; 2000) and the *Canadian Language and Literacy Research Network* (2009), the most scientific support in reading research lies in the teaching of basic sound-letter and word-level skills. Therrien (2004) conducted a meta-analysis and found that efficient low-level word recognition frees up capacity for a higher level of integrative comprehension processing of text. Furthermore, Fuchs and colleagues (2001) found that fluent oral reading from text serves as a performance indicator of overall reading competence. The NRP (2000) report showed that fluency instruction has extensive research support, and numerous authors suggest that the first step is auditory discrimination (i.e., the ability to distinguish the similarities and differences between sounds in a given language; Marchand-Martella et al., 2004), because if sounds are not correctly heard, they cannot be reproduced accurately (Adams, 1990; Badian, 2001; Chall, 1996).

The biological and developmental explanations state that there is a critical age to learn a second language because of the complete hemispheric lateralization by age five (Krashen, 1973). Auditory discrimination becomes less refined with age, and then becomes harder for second language learners to produce new sounds (Flege, 1995). However, Champagne-Muzar and Bourdages (1993) found that discriminative conditioning helps link perceptions of relationships between sound elements within a linguistic system. LeBel (1987, 1990) also recommended auditory discrimination exercises in order for the learner to be able to reproduce the different sounds of a new language. Basically, after recognizing the importance of and assessing the auditory discrimination abilities of students, teachers should instruct new readers from phonemic awareness to phonics in order to respect explicit teaching methods.

Phonemic awareness (i.e., the ability to discriminate and manipulate the sounds in spoken words) comes from a large body of research that has demonstrated the positive effects of its training on beginning reading (Adams, 1990; Armbruster, Lehr, & Osborne, 2001; Carnine et al., 2010; Marchand-Martella et al., 2004; Mercer & Mercer, 2004; Smith, Simmons, & Kame'enui, 1995; Spector, 1995; Stein & Kinder, 2004; Torgesen, 2002, 2004). Also, several longitudinal studies indicated that performance on tasks measuring phonemic awareness in kindergarten or first grade are strong to moderate predictors of reading achievement (Blachman, 1984, 2000; Bradley & Bryant, 1985).

Phonics focuses on the relationship between letters and sounds in written words (Mercer & Mercer, 2004). According to the NRP (2000), the two most common phonics instructional methods have been identified as: synthetic (explicit) phonics, where the sounds for individual letters are pronounced in isolation, and then blended to form words, and analytic (implicit) phonics, where words are identified before the sounds are paired with the letters. The NRP also established that synthetic phonics produces better reading achievement, especially with younger students and students at risk for reading failure, bringing even more support for explicit teaching methods, like Direct Instruction. Chall's (1996) model lies in full alphabetic coding where readers identify how most graphemes represent phonemes in conventional spelling, allowing easy recognition of different words with similar spellings. Such instant recognition also occurs for irregular words that are not decodable using sound-symbol correspondence rules. Essentially, most French phonemes enter that category, where multiple letters together form a single sound (e.g., ail/eil/euil [aij/ɛj/œj]; Lebel, 1990; Silvestre de Sacy, 2000). Furthermore, French language is not considered a highly phonological language (i.e., one letter equals one sound), but rather has sounds composed of two or more letters (Lebel, 1990), which renders grapheme-phoneme correspondence complex. Azoulay-Vicente (1990) found that knowledge of grapheme-phoneme correspondence is crucial in order to avoid creating habits of mispronunciation. Interestingly, Bongaerts, Van Summeren, Planken, and Schils (1997) and Marinova-Todd, Marshall, and Snow (2000) found that adult subjects who received considerable phonetic training could obtain a native-like accent in second language. This finding concurs with Champagne-Muzar and Bourdages (1993)'s result that supervised production allows learner to develop verbal motor automatisms on both pronunciation and prosody.

The NRP (2000) found that one of the more effective fluency-building activities is repeated reading, where students practice reading a passage repeatedly until reaching a certain level of proficiency. Repeated reading is recommended for students who read between first and third grade instructional level (Therrien, & Kubina, 2006) and can be in the form of choral reading, partner reading, or one-to-one reading with an adult (Carnine et al., 2010; Stein & Kinder, 2004). According to Boyer (1993, 2010)'s explicit teaching perspective, all special education intervention targeting automaticity of decoding skills (including repeated reading) should be applied to all schooling levels. In order to encourage automatism, fluency-building strategies can be put in place. The concept of fluency is best described as speed and accuracy combined when executing a task. Another component often added to its definition is time of reaction, but is seen more within the concept of automaticity, where the subject shows no hesitation when responding to a stimulus (Bloom 1986; Carr, 1992). According to Chiesa and Robertson (2000), speed provides a measure of expertise: whether it is carpentry, solving math equations, or reading texts. Fluency involves speed as well as accurate performance (see Bloom, 1986, for a discussion of speed as a criterion of expertise). In Direct Instruction's perspective, reading fluency is defined by the facility in reading a text, words in sentences and passages accurately and quickly, but also with expression and effortlessness (Carnine et al. 2010; Marchand-Martella et al., 2004; Khun & Stahl, 2003). Binder (1988, 1990, 1996), within a Precision Teaching's perspective, mentioned fluency-building strategies when speaking of activities promoting speed and accuracy of execution of any task.

Considering the many benefits of attaining fluency, Chiesa and Robertson (2000) stated that fluency training, as a method that promotes development of the fast and accurate rates on component skills, enhances the learning of new skills. Binder (1990) mentioned that fluent learners are more confident. Carnine and colleagues (2010) maintained that fluency promotes assignment completion and renders school a more pleasant experience. According to White and Haring (1980) fluency is a good indicator of the child's ability to maintain, generalize, and apply a skill outside the classroom. Furthermore, many authors suggest that responses students can produce at a high rate are likely to be remembered and applied long after the initial learning (Haughton, 1980; Lindsley, 1990a; Merbitz, Vieitez, Merbitz, & Binder, 2004; Therrien & Kubina, 2006). However, Heinicke, Carr, LeBlanc, and Severtson (2010) expressed concerns regarding Fluency, a core concept in Precision Teaching, and its applications to the autism spectrum.

Students lacking fluency or accuracy in word pronunciation skills (e.g., less than 135 words per minute) show poor reading comprehension (Binder, 1996; Carnine et al., 2010; Pinnell, Lyons, DeFord, Bryk, & Seltzer, 1994). They also show slower progress than students who read at a more appropriate rate for their age or grade level placement, and tend to be less self-motivated than proficient readers, being less likely to read outside the classroom and out of school (Rasinski, 1999, 2000). When lacking reading fluency, each word is treated like isolated units rather than meaningful sequences. It requires for students to invest more time in the reading task than their fellow students who are reading at an appropriate rate for their grade level. Oral repeated reading with guidance and feedback improves fluency, and has a positive impact on reading comprehension (Carnine et al., 2010; LaBerge & Samuels, 1974). Oral reading fluency serves as a gauge of basic reading competence and may also serve as a global reading competence measure. It captures individual differences in a number of reading subcomponents at lower and higher levels of processing (Fuchs et al., 2001). It should be added into classroom-based assessment so that its datum can be taken into consideration when formulating educational decisions (Shinn, 2001). Oral reading fluency can also be used in two different manners: first within a normative framework, where performance levels can be compared between individuals. Secondly, gains or performance slopes can track the development of reading competency within a reader (Fuchs et al., 2001).

Finally, the knowledge of letter names has proven to be one of the best predictors of beginning reading achievement (Adams, 1990; Torgesen, Wagner, & Rashotte, 1994). In fact, letter-naming facility has demonstrated itself as an excellent predictor of reading achievement even through the seventh grade (Adams, 1990). However, it is not simply the accuracy, but the fluency with which children can correctly name letters that is related to reading success. Fluency is considered an important part of reading interventions. As for fluently identifying letter sounds, it facilitates word decoding and recognition, while also has an effect on oral reading fluency (Kubina, Young, & Kilwein, 2004; Mercer, Campbell, Miller, Mercer, & Lane, 2000; NRP, 2000).

Self-monitoring

Self-monitoring, essentially used in clinical and educational settings for the last two decades (DiGangi, Maag, & Rutherford, 1991; Mace & Kratochwill, 1988; Sutherland & Snyder, 2007), was introduced in resource classes, self-contained settings with students of varying disabilities, and in general education. Self-monitoring intervention refers to a practice where students are educated on documenting their own behaviors (Mammolenti, Vollmer, & Smith, 2002). Self-monitoring has shown improvement in academic skills, for example enhancing productivity and accuracy in reading (Carr, & Punzo, 1993; DiGangi et al., 1991; Harris, 1986; Kolic-Vehovec, 2002; Lalli, & Shapiro, 1990; Mammolenti et al., 2002; Reid, & Harris, 1993; Rock, 2005; Rock, & Thead, 2007; Schwartz, 1997; Skeans, 2000). According to numerous authors (Lalli & Shapiro, 1990; Mace & Kratochwill, 1988; Nelson & Hayes, 1981) to self-monitor a student has to self-assess, and self-record. A student self-assessing has to judge as to whether a particular behavior occurred (Mammolenti et al., 2002). It includes an element of comparison from one's behavior to a certain standard to evaluate progress to established criteria (DiGangi et al., 1991; Mercer & Mercer, 2004). In self-recording, the student documents his own behavior by filling out, for example, a form, journal, checklist, etc. (Mammolenti et al., 2002). Webber, Scheuermann, McCall, and Coleman (1993) reported that the act of self-recording behaviors is ample enough to cause unwanted ones to decrease, even for only a short period of time without reinforcement. Results obtained by Critchfield and Vargas (1991) on the immediate social environment and the reactivity to self-recording show that the two variables are independent. Moreover, the results from Lalli and Shapiro (1990) indicated that the introduction of contingent reward did not increase the reactivity to self-recording. Another way to keep track of changes over time while self-monitoring is to use graphs.

Self-graphing. Self-graphing is the activity of students recording on a graph their own behaviors or academic performance. Many authors in different fields have studied the effects of students self-graphing on: (a) computerized data management (Gunter, Miller, Venn, Thomas, & House, 2002); (b) reading performance (Gunter, Miller, & Venn, 2003); (c) students' preparedness (Hylan & Keaton, 1994); (d) improving classroom instruction (Moxley, 1998, 2007); (e) written expression (Stotz, Itoi, Konrad, & Alber-Morgan, 2008); (f) reading fluency and classroom behavior (Sutherland & Snyder, 2007); and (g) completion of homework assignments (Trammel, Schloss, & Alper, 1994). In Precision Teaching, self-graphing is called *self-charting* (Lindsley, 2010). Lindsley (1990a) demonstrated that students learn more rapidly when self-charting than if their teacher were to chart for them. Moxley (2007) suggested self-graphing allows for learning of transversal competencies like learning about math concepts of graphs, measurements and data gathering applied in other classes. Furthermore, Lindsley (1991) asserted that charting gives a visual representation of progress over time that is more informative than grade books and score tables.

Several advantages to self-graphing have been documented. For example, it has been found to enhance teacher decision-making (White & Haring, 1980). It decreases teacher's time and responsibilities in monitoring students' work and progress, thus allowing them to offer more support to students in need. Furthermore, it enhances reactivity to self-monitoring by decreasing unwanted behaviors and increasing academic performance (DiGangi et al., 1991; Gunter et al., 2002; Lindsley, 1990a; Moxley, 2007; Sutherland & Snyder, 2007). Self-graphing also allows continuous data collection (Lindsley, 1990a, 1990b; Moxley, 1998). Furthermore, Rock (2005)'s study showed that students involved in the decision-making process greatly improve their behavioral and academic performance. Students learn how to exercise choice and execute decision-making skills on a daily basis. Lindsley (1990a, 2010) stated that students will develop trust by not having the teacher double-checking his counts, and added that students develop life-long self-monitoring skills that can be applied to many other settings. Motivation is improved for the teacher when finding better instructional conditions, and for students when seeing their performances improve (Moxley, 2007). Students have also expressed enthusiasm in graphing their own performance data, adding a motivational component (Gunter et al., 2002).

Precision Teaching. Created by Lindsley in 1965, Precision Teaching is proposed as a simple and permanent verification method of learning behaviors, allowing for regular data collection, from a yearly, monthly, weekly to a daily charting procedure (Lindsley, 1972). Data is gathered from a typical one-minute *timing* (i.e., timed practice session) and then charted on a specific graph. Precision Teaching can be combined with any teaching method or curriculum (Lindsley, 1971, 1991, 1997; West & Young, 1992; White, 1986; White & Haring, 1980) and all types of observable and measurable behaviors (i.e., academic, personal, motor, linguistic, affective, etc.) can be assessed and monitored with PT procedures (Giroux & Lévesque, 2001). While students should be self-charting (Lindsley, 2010), teachers need to use the scores and slopes (regression line; White, 2011) to assess the level of performance and evolution of a student or a group of students. An informed decision about the class activities, curriculum, or teaching method can then be made (Kubina, 2005).

Standard celeration chart. The *Standard Celeration Chart* (SCC; see Figure 1) is a graph developed by Lindsley (1972) with the purpose for all Precision Teaching users, no matter what frequency is observed, to be able to easily and quickly share information without the hassles of explaining the particularities of different graphs (Lindsley, 1991, 2010). The behavior frequencies range from .001 behavior per minute (one behavior per day) to 1000 behaviors per minute. The standard chart was used millions of times (Calkin, 2002) to record a vast array of different behaviors from school learning (e.g., reading, writing, math), behavior modification, social skills, specific frequencies like fetal movement, number of publications, etc. (Calkin, 1983; Commons, 2003; Fitzgerald & Garcia, 2006; Giroux & Forget, 1996; Schuessler & Forget, 2009; Spence, 2002; White, 2002; Zambolin, Fabrizio, & Isley, 2004). The SCC is called standard because it is the official and only chart acknowledged by all users in the PT field. In fact, the *Journal of Precision Teaching and Celeration*, the official publication of the PT society, only publishes the standard chart. An important technical aspect of the SCC is its semi-logarithmic scale. The chart is logarithmic on the ordinate, composed of six superimposed cycles of a multiple of 10 in order to respect proportions of behavior increase in frequencies (Baer & Parsonson, 1981; Lindsley, 2010). The SCC has a stable 34-degree angle from bottom-left-corner to upper-right-corner. This specific angle allows the tracing of a slope representing frequency doubling every seven days on the abscissa. The abscissa is an arithmetic scale composed of regular calendar days. The standard chart contains half an academic year on one page, and should be synchronized with the school calendar, particularly when used in that setting.

Using behavior frequencies, charting is based on one-minute *timings* (i.e., one-minute timed reading periods), where a ratio of *corrects* (i.e., accurate responses) and *errors* (i.e., inaccurate responses) per minute are inscribed in order to monitor progress within a student or group of students. Sometimes, when material is of longer length, students will be offered a two-minute timing instead of the usual one-minute timing (Sroka, 1990). With struggling students, 30-second and 15-second timings can be granted to change the celeration coefficient (Kubina, 2005). However, it is a current practice to use one-minute timings, for example, in PT and DI, as it seems practical (Calkin, 2005; Carnine et al., 2010; Lindsley, 1971, 1997, 2010; Marchand-Martella et al., 2004; Vargas, 2009; White & Haring, 1980). Both Billières (1987) and Morley (1988) suggest exploiting a systematic and personalized approach to the teaching of a second language. They also suggest using files with easy access for each learner to keep track of progress. Precision Teaching charts can be used to answer both needs for individualization and daily tracking of students' progress.

An alternative: The standard alternate celeration chart (SACC). Created by Giroux and Crow in 2000, the SACC (figure 2) has a "span" extending from 0 to 500 on one chart. It derives from a combination of two charts from the first author (Giroux & Forget, 1996; Giroux & Lévesque, 2001). This new span integrated on one chart allows measuring oral reading with low performing students (low frequencies) as much as with more skilled students (high frequencies) all in the same regular classroom. It is the first time that a PT Chart starts with a zero, the official SCC adopting other rules (White & Haring, 1980). This "zero" was incorporated to the chart after students requested it persistently, zero corresponding to the absence of behavior (e.g., absence of error). Finally, the return to the paper format of 81/2 by 11 inches instead 81/2 and 14 inches makes the chart a practical tool by allowing it to be inserted easily in a binder or a notebook.

Low Achievers Versus High Achievers

Frederiksen (1981) established that the number of errors when reading words in context does not as a rule distinguish groups of high and low-ability readers. Instead, the chronometric aspect of processing, as reflected in oral reading rate, will consistently provide a basis for discerning levels of reading expertise. In other words, performance on timed readings is a good indicator of whether the reader is a low or high achiever.

When comparing the differences between high and low achievers, Adams and Engelmann (1996), state that high achievers require less repetition, less review, fewer examples, and often less reinforcement than lower achievers. Furthermore, low achievers may have concept and skill deficiencies that require time to remedy. Nonetheless, although lower IQ students consistently start lower on reading and math measures than higher IQ students, and end up also lower on the same measures, the gains made by lower IQ students are as much on every measure as the gains made by higher IQ students (Becker, 1992; Gerstein, Becker, Heiry, & White, 1984; Watkins & Slocum, 2004).

To summarize, research on self-graphing and Precision Teaching has shown many benefits for students. Even if present in the scientific literature for the last two decades, the combination of Precision Teaching and Direct Instruction is still relatively unused by teachers (Kubina, Commons, & Heckard, 2009; Legault, Maloney, & Giroux, 2001; Maloney, Desjardins, & Broad, 1990; Stenseth & McLaughlin, 1996). To our knowledge, no study to date has combined Precision Teaching and Direct Instruction's format and components in a French as a second language course.

The present empirical study is particularly positioned within a tradition of inductive research, rather than hypothetical-deductive process. It focuses on research objectives, as it is a tradition in Precision Teaching to do so and to collect data directly on standard charts (Lindsley, 2010; Vargas, 2009). In fact, among all evidenced-based educational methods, Precision Teaching is probably the most inductive one; PT has been collecting and recording data on millions of charts over numerous years (Calkin, 2002). It should be noted that the general purpose of this study is to evaluate the effects of self-graphing on the *Standard Alternate Celeration Chart* of read French phonemes, and not to demonstrate the superiority of the procedure compared to any other teaching method or self-monitoring tool and procedure. This research, after gathering a large quantity of data on self-graphing on the SACC, presents the generalities and discoveries emerging form the data regarding its effects on the performance of 63 typical students. Differences in self-graphing effects between typical low and high achieving students are also analyzed.

Research Objectives

The first research objective is to examine the effects of self-graphing reading fluency of French phonemes, using the *Standard Alternate Celeration Chart*, by seventh and eighth graders enrolled in a French as a second language course. The second research objective was to discern whether self-graphing reading fluency of French phonemes on the SACC had a different impact for typical low and high achievers.

Method

Students

Sixty-three seventh and eighth graders, boys and girls aged from 12 to 14 years old, graphed their reading rates. Students came from a Charter school in the metropolitan area of Denver, Colorado. About 15% of the student population of the school qualified for the free and reduced lunch program. The ethnic composition was 3% Asian/Pacific Islander, 3% African American, 29% Hispanic, 1% Native American and 64% Caucasian (Littleton Preparatory Charter School, 2011). Only students taking a daily 40-minute period of French as a second language course were included in the study. Written parental consent was obtained for all students participating in the study, respecting confidentiality and anonymity.

According to a school-wide procedure, based on DI placement tests found in the Corrective Reading series (Carnine et al., 2010; Engelmann et al., 1999a, 1999b; Slocum, 2004), students were assigned to different classes according to their English reading performance. The distribution of the participants in each class was as follows: Class 1 $n = 23$ (9 boys, and 14 girls); Class 2 $n = 19$ (13 boys, and 6 girls); Class 3 $n = 8$ (5 boys, and 3 girls); and Class 4 $n = 13$ (8 boys, and 5 girls). Additionally, to analyze data according to low and high achieving standards, students were then divided in two groups following the median score on the practice sheets for low and high achievers (see Table 1).

Reading Basic Skills Tasks

The tasks, inspired by Direct Instruction procedures, consisted of "see-touch-say" of letters (Carnine et al., 2010; Engelmann et al., 1983; Graf, 2000; Haughton, 1980) as well as French phonemes inspired by the Borel-Maisonny teaching material (Silvestre de Sacy, 2000). The number of letter names and phonemes were measured in timed reading short periods, called timings. Timings were performed at least four days a week, collecting frequencies on two practice sheets corresponding more precisely to the number of letters and phonemes that were read by students correctly and incorrectly per minute. These frequencies will be referred to as *correct* for an accurate response, and *error* for an inaccurate response (i.e., an error being an omission, confusion, or a mispronunciation).

Material. Flashcards were used in the classroom to teach letter names and phonemes. Practice sheets made of letters, and then from simple phoneme letter combinations made of two letters (e.g., ba/be/bi/bo/bu [ba/bə/bi/bo/by]), to more complex phonemes made of two or more letters making one sound (e.g., ail/eil/euil [aij/ɛj/œj]) were presented to the students during timings.

Teaching strategy. On a weekly basis, the experimenter cooperatively with the teacher developed the phonetically based French curriculum. Flashcards and homemade practice sheets, inspired by Silvestre de Sacy's (2000) update of Borel-Maisonny method, were used to teach students letter names and phonemes. Flashcards were used while group-teaching French phonemes, following the DI teaching method: the teacher showed the flashcards one at a time to all students, read the phoneme out loud, paused, gave the students a signal to respond, and asked for either group or individual responses (Carnine et al., 2010; Engelmann et al., 1983).

According to the DI format, students sit in a semi-circle: low achievers in the middle of the front row, and high achievers in the back row or the sides. Delivery of the lessons followed the format: model-lead-test, signal, and immediate feedback and correction during group instruction (Carnine et al., 2010; Engelmann & Carnine, 1991).

The practice sheets were laminated and students used an erasable marker; the material was always available and ready for the following class. Students took the appropriate practice sheet according to the color code posted on the wall of the classroom. Each color represented a phase change, for example, after attaining the prescribed aim during three consecutive days the student changed his practice sheet for the next one on the list (Carnine et al., 2010). The level of fluency, first established by the teacher's performance on the practice sheet, could also be adjusted according to the best performing student. All students tried to attain the same aim set for all classes. This process follows procedures as seen done previously by M. Maloney of QLC Educational Services (personal communication, December 3-4, 1999) and by I. Spence of Ben Bronze Academy (personal communication, May 8-12, 2000).

Procedures

At the beginning of the school year, students were informed about the research project conducted in their French as a second language course as part of their daily activities. The project lasted for 13 weeks during the fall semester.

Treatment consisted of implementing self-graphing on the SACC (see Figure 1), a graphic procedure of Precision Teaching to monitor learning (Giroux & Crow, 2000; Giroux & Lévesque, 2001). Four to five times a week, between Monday and

Friday, students were timed for 30 seconds on their two different practice sheets. The use of 30-second timings, already established school-wide, is an alternative to the single one-minute timing commonly used in Precision Teaching. Consisting of a total of one minute of timed readings per day, these timings entailed a participation of around 10 minutes included in the classroom activities.

Design. The design is a multiple-baseline research design across participants (Barlow & Hersen, 1984; Kazdin, 1982; Martella, Nelson, & Marchand-Martella, 1999). School *treatments*, like learning a second language, bring permanent changes in a person's behavioral repertoire. Thus, any return to baseline to test the treatment effect is impossible. Moreover, applied settings are reluctant to withdraw a beneficial program or deprive students of such a program for the sake of establishing a control group (Bordens & Abbott, 1999; C. Clément, personal communication, February 20, 2009; Martella et al., 1999). Therefore, the multiple-baseline design across participants is a research scheme that provides an answer to both these challenges (Bordens & Abbott, 1999; Martella et al., 1999). Martella and colleagues evaluated positive effects of the multiple-baseline design with examples taken from applied behavior analysis: reading, following first-aid instructions, math problem-solving, relaxation training, and self-monitoring.

Experimental condition. During the initial baseline, data were collected concurrently (Carr, 2005), starting the same week for all classes at baseline and consisting of 11 data-points following prescribed procedures (Bloom, Fisher, & Orme, 2009; Giroux & Lévesque, 2001; White & Haring, 1980). The students did timings and self-recording by keeping scores on their score-sheet. They did not know the SACC would be used yet. Then, the French teacher introduced the SACC with one class at a time: students from Class 1 began self-graphing their scores. At intervals of seven measured days students in Class 2 started self-graphing, then students in Class 3, and finally students in Class 4 following the same procedures. Student self-graphed their scores, but neither draw nor calculated celerations. Their aim was to attain 120 French phonemes per minute for three consecutive days, and then change practice sheet while marking the phase change (i.e., change in practice sheet) by putting a vertical line on the SACC.

Data collection. When the teacher started the timer, students read aloud and in unison the content of their practice sheet. While reading out loud, the teacher walked around the classroom, correcting students directly on their practice sheet. The correction consisted of a slash through mispronunciations, wrong, or skipped answers given by the student (Boyer, Morrisset, & Giroux, 1999; White & Haring, 1980). When the timer went off, the students stopped immediately and circled the last letter or phoneme read as suggested by Boyer and colleagues (1999). They next wrote their total of corrects and errors on a score sheet. Finally, students charted their scores on their SACCs.

Controlled variables. The teacher used the same basic curriculum and teaching material (i.e., flashcards and practice sheets) inspired by Direct Instruction and the Borel-Maisonny (Silvestre de Sacy, 2000) methods for all students. The teaching sequence was one and the same for all classes. Moreover, the experimenter introduced PT with the SACC to the students using an identical script with all four classes based on a modified version of a model created by Maloney (1998). Finally, periodic accuracy checks were performed in the classrooms while gathering data.

Results

The first research objective was to examine the effects of self-graphing reading fluency of French phonemes on mean performance and celeration. This was assessed with the help of the SACC by seventh and eighth graders enrolled in a French as a second language course.

Two types of statistics were used: classical statistics consisting of the mean frequency of correct letters and phonemes read per minute, and Precision Teaching statistics consisting of celeration coefficients to assess the evolution of the learner on a chart. The *celeration coefficient* consists of a score reflecting the best-fit line drawn through a set of frequency points on a chart (this case–the SACC). *Celeration multipliers* were used to compare learning rates between baseline and treatment (an explanation is provided further below).

Mean performance was analyzed using a total of two two-way ANOVAs with repeated measures on one factor: with the fours classes of the multiple-baseline design and achievement group (i.e., low versus high achievers) as between-subjects factors. ANOVAs were only performed for corrects and not for errors since there was no variance to analyze due to a pronounced floor effect; more than 20% of recorded values for errors were zero.

Visual Inspection of Charts

White and Haring (1980) indicated that at least 10 observations should be recorded in order to better predict the evolution of targeted behaviors. The most remarkable change in performance across all students was observed during the first 11 days at baseline (see Figure 3). The visual inspection of corrects and errors on the SACC for practice sheet 1 and practice sheet 2 (see Figure 4 and 5) shows a quick increase, then a maintenance at aim for the first as well as a considerable decrease and maintenance for the second throughout baseline and treatment combined for all students.

Classic Statistical Analyses–Mean Performance

A significant main effect for time was found, $F(1, 59) = 76.18$, $p < .001$, $\eta^2 = 0.52$, showing an overall effect of treatment across multiple-baselines. Means and standard deviations at baseline and treatment were as follow: $M = 107.19$, $SD = 15.71$; $M = 126.60$, $SD = 15.06$. The Time x Class interaction was significant, $F(3, 59) = 4.02$, $p = .001$, $\eta^2 = 0{,}08$, indicating that the pattern of change for both times differed across the four multiple-baselines. The main effect for multiple baselines was not significant, $F(3, 59) = 1.07$, $p = .371$, $\eta^2 = 0.05$, indicating that all four classes were behaving the same.

Table 2 shows the simple effects on the interaction Time x Class. Although all *t*-test values were significant, Class 1 showed a larger gain during treatment than the other three classes.

Precision Teaching Statistical Analyses–Celeration

Table 3 shows the analyses of celeration coefficients at baseline and treatment for all classes on practice sheet 1 and 2. *Celeration multiplier* indicates the residual value of progress from baseline to the treatment phase. In this case, for Class 1 on practice sheet 1 there is a celeration coefficient of x1.04 at baseline divided by a celeration coefficient of x1.00 in treatment, equal a celeration multiplier of ÷1.04. No significant celeration coefficients are found at baseline and treatment for all classes on practice sheet 1 and 2, according to the x1.25 minimal celeration coefficient (Lindsley, 2010; White & Haring, 1980).

Comparisons of Low and High Achievers

The second research objective was to discern whether self-graphing academic performance on the SACC had a different impact for typical low and high achievers while reading French phonemes. In order to do so, the sample was divided in two achievement level groups based on the median of the mean of the practice sheet 1 and 2 ($r = .873$, $p < .001$). Distribution of students was as follows: low achievers, $n = 32$, and high achievers, $n = 31$.

Classic Statistical Analyses–Mean Performance for Low and High Achievers

The Time x Achievement group interaction was significant, $F(1, 61) = 19.50$, $p < .001$, $\eta^2 = 0.10$, indicating that the pattern of change for both times differs across the two groups. Figures 6 and 7 indicate that the lower performers had lower means both at baseline and treatment than the higher performers for practice sheet 1 and 2.

However, by comparing the mean performance for both groups at baseline and treatment, there was a gain of more than twice the amount for low achievers (i.e., practice sheet 1 = 27.18 compared to 11.38) even if their means were lower during both times which is consistent with results found in literature (Becker, 1992; Watkins & Slocum, 2004). The presence of two different groups has been confirmed by a significant main effect for achievement group, $F(1, 61) = 32.93$, $p < .001$, $\eta^2 = 0.35$.

Discussion

The study's main objective was to evaluate the effects of self-monitoring on reading fluency of French phonemes with the SACC. Seventh and eighth graders attending French as a second language course self-graphed according to a multiple-baseline design implementation of PT procedures. The most striking change in performance across all participants occurred during the first 11 days of baseline (see Figure 3). All students starting new tasks were producing already high mean performance for corrects. An effect of reactivity to observation can be presumed: researchers' instructions (i.e., read at least 120 French phonemes per minute or above for three consecutive days), reward for progress (i.e., then you get a new practice sheet with different French phonemes), the fact that the recording instrument is obtrusive (i.e., students chart after each timing), and the intense schedule of self-monitoring (i.e., 4-5 days per week) are all factors that could have played a role in explaining the results displayed on Figure 4 and 5 (Bloom et al., 2009). The general frequency pairs (corrects and errors), to be consistent with an effective PT intervention, should show an increase of correct and a decrease of incorrect response over trials (Pennypacker, Gutierrez, & Lindsley, 2003; White & Haring, 1980). However, in the present study the results show reactivity to observation right from the beginning of baseline, and then reach a possible ceiling of how fast one can read French phonemes at the end of baseline and during the whole phase of treatment.

When focusing attention on students' celeration coefficients, an absence of treatment effect can be observed (see Table 3). This seems contradictory with the results for mean performance obtained by classic statistical analyses indicating that students read more fluently French phonemes at treatment than at baseline. Nevertheless, it can be explained by the following: (a) task similarities, (b) physical ceiling, (c) unknown monitored aspects, and (d) unmonitored motivational aspects.

The practice sheets comprising different French phonemes, even if changed after three days at aim, may have been too similar to observe the effect of self-monitoring on new tasks. This is reflected by the students starting a new practice sheet with a high mean performance for corrects and an already low mean for errors. There may be a human *physical* ceiling to be reached on how fast a person can read out loud French phonemes correctly, therefore preventing students from improving more than they did. Finally, when attaining a ceiling, it is rather difficult for a learner to increase its performance since there isn't any more possibility to improve and no more mistakes to make.

What if students were monitoring an aspect we had not thought of? Students could have been self-monitoring the rate of French phonemes read before they were introduced to the SACC chart and its procedures. In fact, students had already been using the SACC in other courses.

Furthermore, students could also have been satisfied with a certain amount of phonemes read, and were not motivated in attaining a higher performance than the already set aim. Maybe the change of practice sheet may not have been rewarding for students, influencing the mean performance and celeration coefficients. However, anecdotally, the students reported liking performing timings and the routine set up in the classroom, which was consistent with results found in the literature (Gunter et al., 2002). We did not explore the motivational aspects of the timings in themselves and of the practice sheets.

The impressive gain for Class 1 (see Table 2) can be explained by the fact that it is the first class of the research design to get the SACC implemented. Thus, the results are more imprinted by the possibilities of: (a) the observation bias; (b) the learning of a *new* task; (c) the fact that the students have not reached a ceiling, yet (see Figure 3); and (d) a combination of all of these. Because of a time-limit allotted in classrooms for timings and PT, slopes and celeration coefficients were neither taught nor used with students of all classes, which may have contributed to the lack of treatment effect on students' performance as seen by PT statistical analyses. Empowering students with these PT statistical analyses could have made a greater impact on self-monitoring the SACC, and that would need to be tested in further research. This brings up-front the problem with Precision Teaching implementation in regular classrooms and the time that it takes for teachers and students to incorporate the PT procedures in the teachings of the curriculum content.

Low Versus High Achievers

The second objective of the study was to assess the differences in the effects of self-graphing on reading performance with the SACC between typical high and low achievers. The results indicated that both the low and high achievers increase their performance in reading fluency of French phonemes in French as a second language courses. It is also interesting to observe that low achievers obtain an academic gain in treatment more than twice the amount of the one gained by the high achievers (practice sheet 1 = 27,18 versus 11.38). Those results are consistent with results reported in Direct Instruction literature (Adams & Engelmann, 1996; Becker, 1992; Watkins & Slocum, 2004), but no such comparative study has been previously conducted in Precision Teaching. However, it is also possible that high achievers, having reached a ceiling, do not show as remarkable progress as the lower achievers, thus allowing lower achievers to match their performance.

Implications and Limitations of the Study

The originality of this study lies in the fact that it is the first time that self-graphing Precision Teaching procedures were applied to the learning of French as a second language. This is also the first time that the *Standard Alternate Celeration Chart* was used in a research study. Furthermore, the pertinence of this study lies in the in-depth investigation of the impact of self-graphing of academic performance on the SACC while seventh and eighth graders read French phonemes in a French as a second language course. The pertinence lies also in the comparison of self-graphing typical low versus high achieving students. Results confirmed that low performing students, even with lower grades at baseline and treatment compared to higher achievers, profit from a highly structured educational method like Precision Teaching and Direct Instruction (Adams & Engelmann, 1996).

Although original, this study also has its limitations. The SACC had already been implemented school-wide: Students were already self-graphing with it in other courses such as math, science, history, English reading, etc, thus making the implementation of the SACC procedures in French as a second language classes simple for this study. Other schools might be reluctant to add to their teachers' load (Giroux & Forget, 1996; Schuessler & Forget, 2009). Furthermore, by previously using the SACC in other courses, students might already have had a mental scheme of their mean performance during baseline, therefore introducing an extraneous variable. Considering external validity, generalization of the research's results to all French as a second language students is limited since different schools work with different curricula suggesting a need for caution in the interpretation of the results. Moreover, the tasks used for this study might have been too similar and introduced a generalization of learning. Finally, a *physical* ceiling on how fast a human mouth can move in reading French phonemes could have been foreseen.

Conclusions and Future Prospects

In conclusion, although further work is required to gain more complete understanding of the impact of self-graphing on French as a second language reading fluency, our findings indicate that all students read more fluently French phonemes at treatment than at baseline. Even if celeration coefficients of self-monitoring on the SACC show no effect on the students' performance contrarily to reported results and expectations by Lindsley (1971, 1990a), self-graphing on the SACC allows observation of an overall picture of students' learning from day one of the experiment. The SACC served the same purpose in Precision Teaching as the radiograph would for a radiologist looking into a patient's body: diagnostic and progress monitoring. Maybe by using tasks that offer a larger discrepancy between them, other research could better verify the impact of the self-monitoring of the SACC on performance.

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Table 1

Students' Distribution by Achievement Levels and Gender in the Four Multiple-baseline Classes

		Achievers			
Class	*N*	Low	High	*N* (Male)	*N* (Female)
1	23	7	16	9	14
2	19	13	6	13	6
3	8	4	4	5	3
4	13	7	6	8	5

Table 2

Simple Effects on the Interaction Time X Class on Reading Performance Scores

	Mean (SD)				
Class	Baseline	Treatment	Gain	*t*-test	*p*
1	102.73 (19.25)	130.25 (18.02)	27.52	$t(22) = 9.83$	< .001
2	114.54 (14.49)	127.14 (11.26)	12.60	$t(18) = 3.02$	.007
3	105.58 (6.68)	118.33 (8.99)	12.75	$t(7) = 2.96$	.021
4	105.33 (11.25)	124.44 (16.22)	19.11	$t(12) = 4.76$	< .001

Table 3

Celeration Coefficients at Baseline and Treatment for Practice Sheets 1 and 2 Per Class, and Celeration Multiplier Values

	Celeration		
Practice Sheet	Baseline	Treatment	Celeration Multiplier
1			
PS1	1.04	1.00	÷1.04
PS2	1.02	1.00	÷1.02
2			
PS1	1.01	1.00	÷1.01
PS2	1.01	1.00	÷1.01
3			
PS1	1.01	1.00	÷1.01
PS2	1.01	1.00	÷1.01
4			
PS1	1.01	1.01	x1.00
PS2	1.01	1.00	÷1.01

Figure 1. Standard Celeration Chart (SCC).

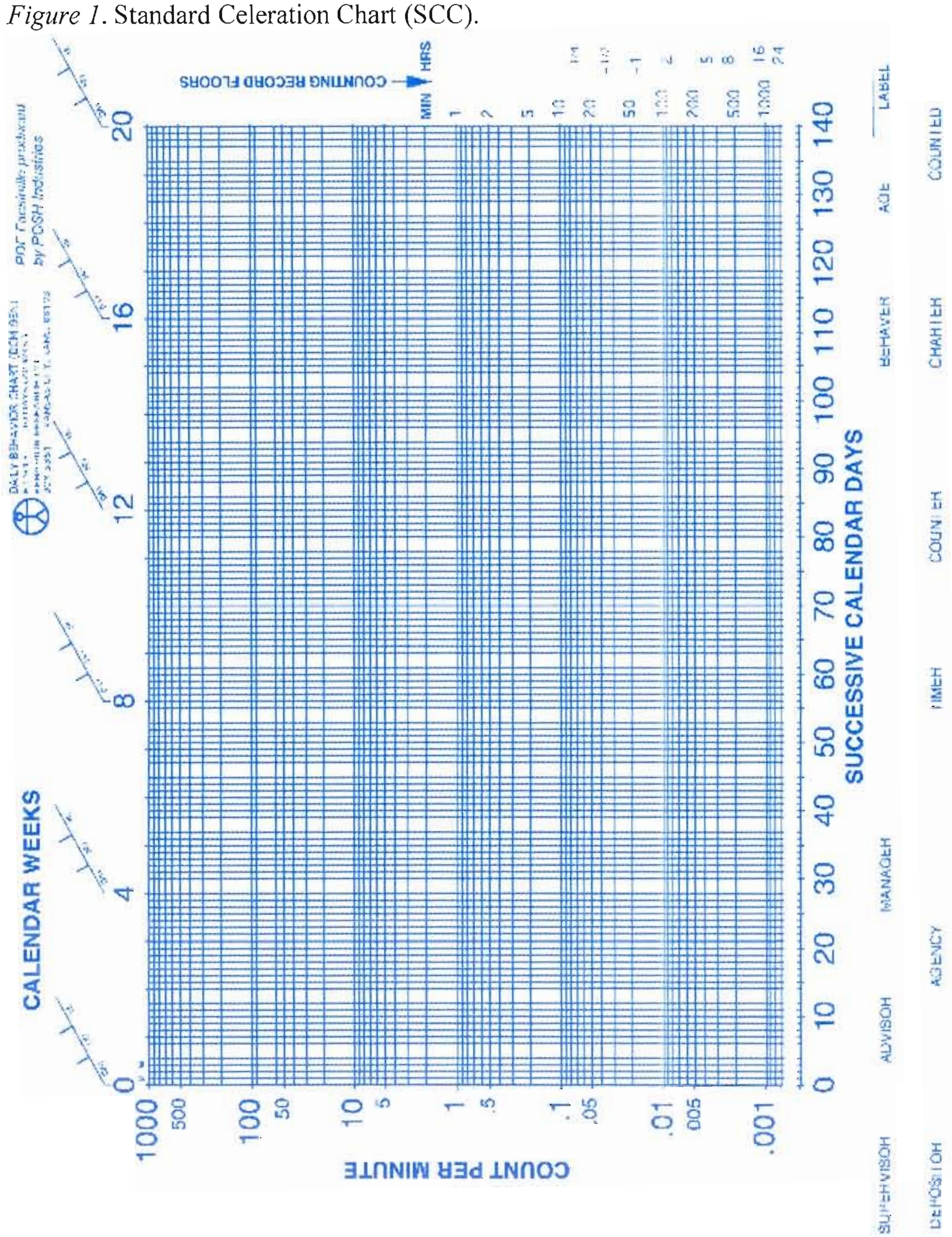


Figure 2. Standard Alternate Celeration Chart (SACC).

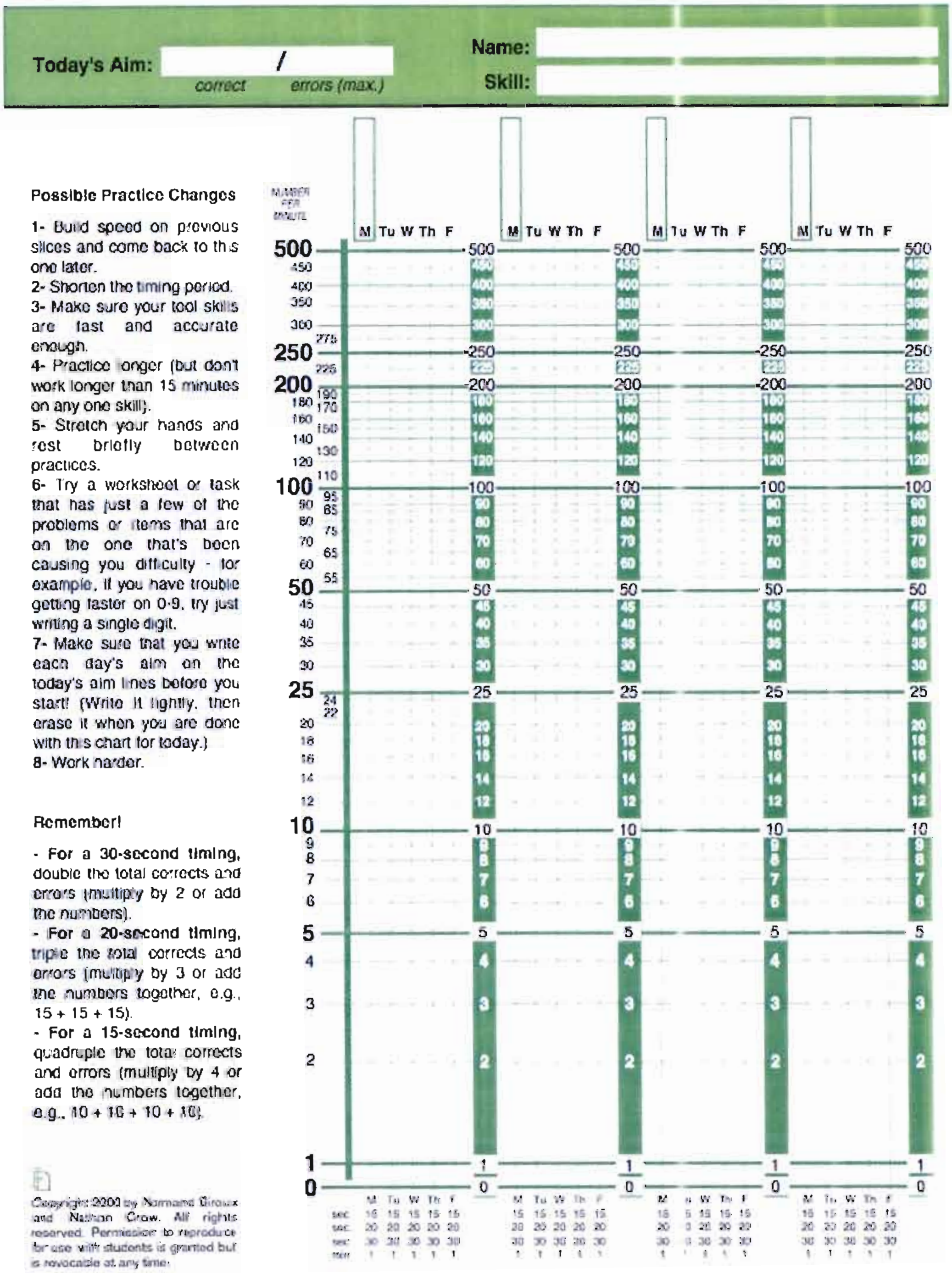


Figure 3. Mean Reading Performance Across Classes 1 to 4 at Baseline and Treatment.

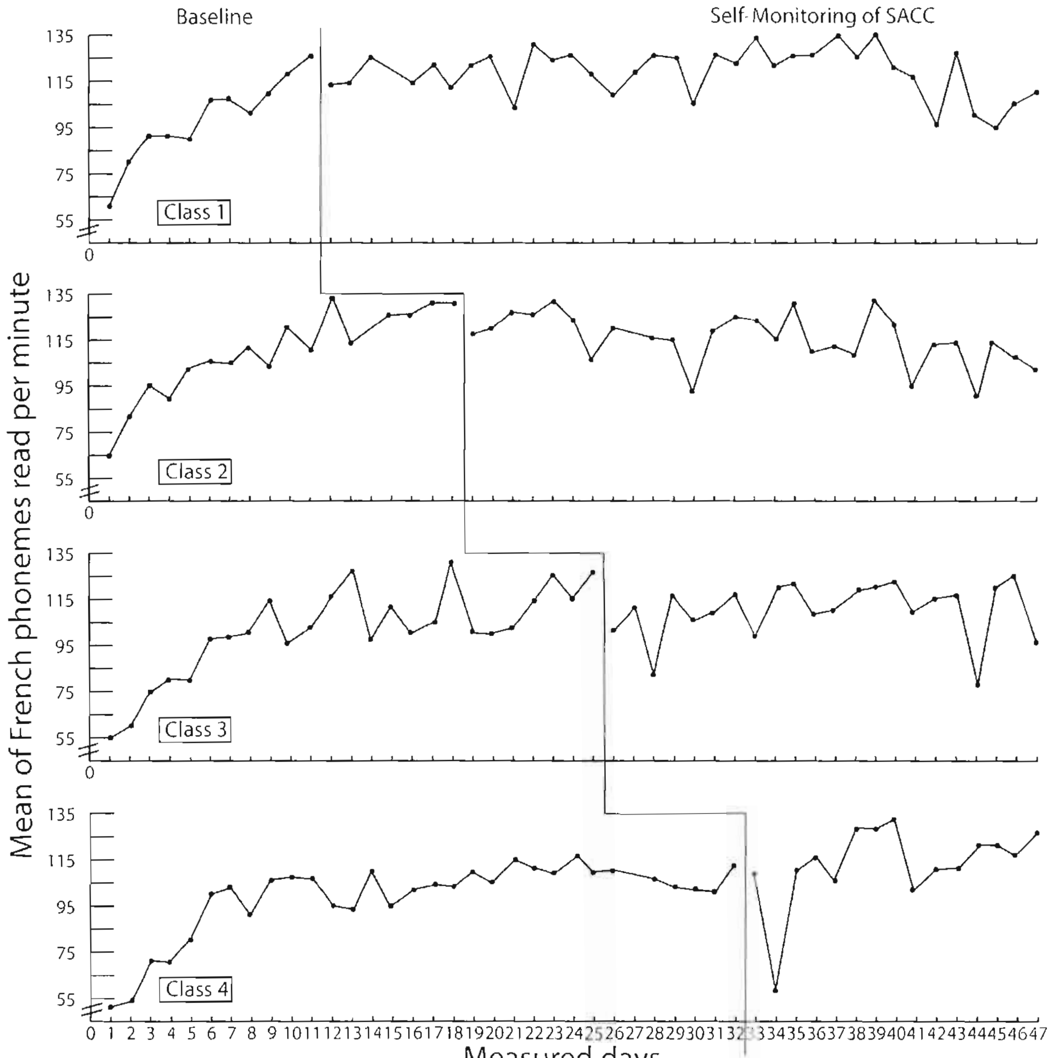


Figure 4 (1/4). SACC of Reading Frequencies for Classes 1 to 4 on Practice Sheet 1.

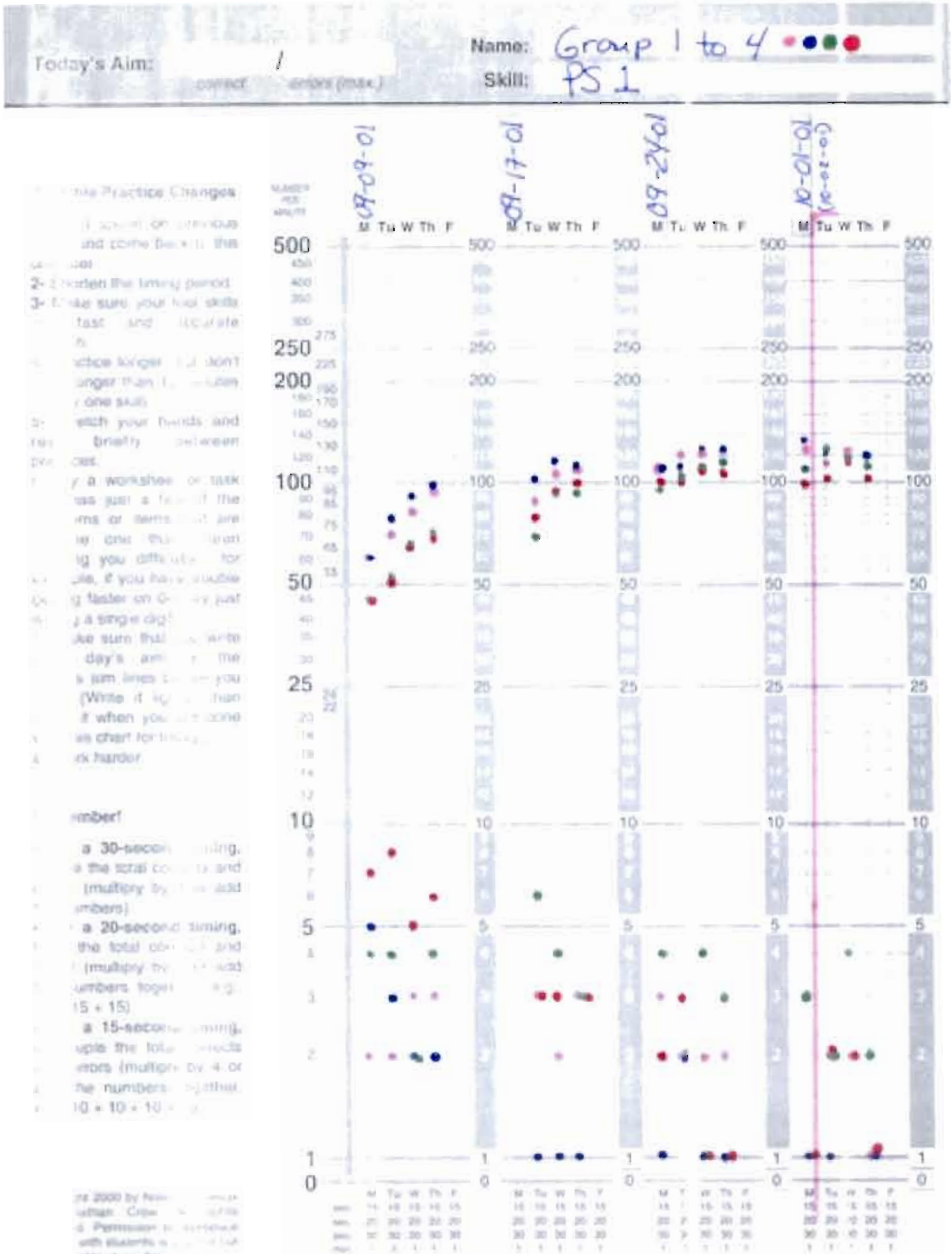


Figure 4 (2/4). SACC of Reading Frequencies for Classes 1 to 4 on Practice Sheet 1.

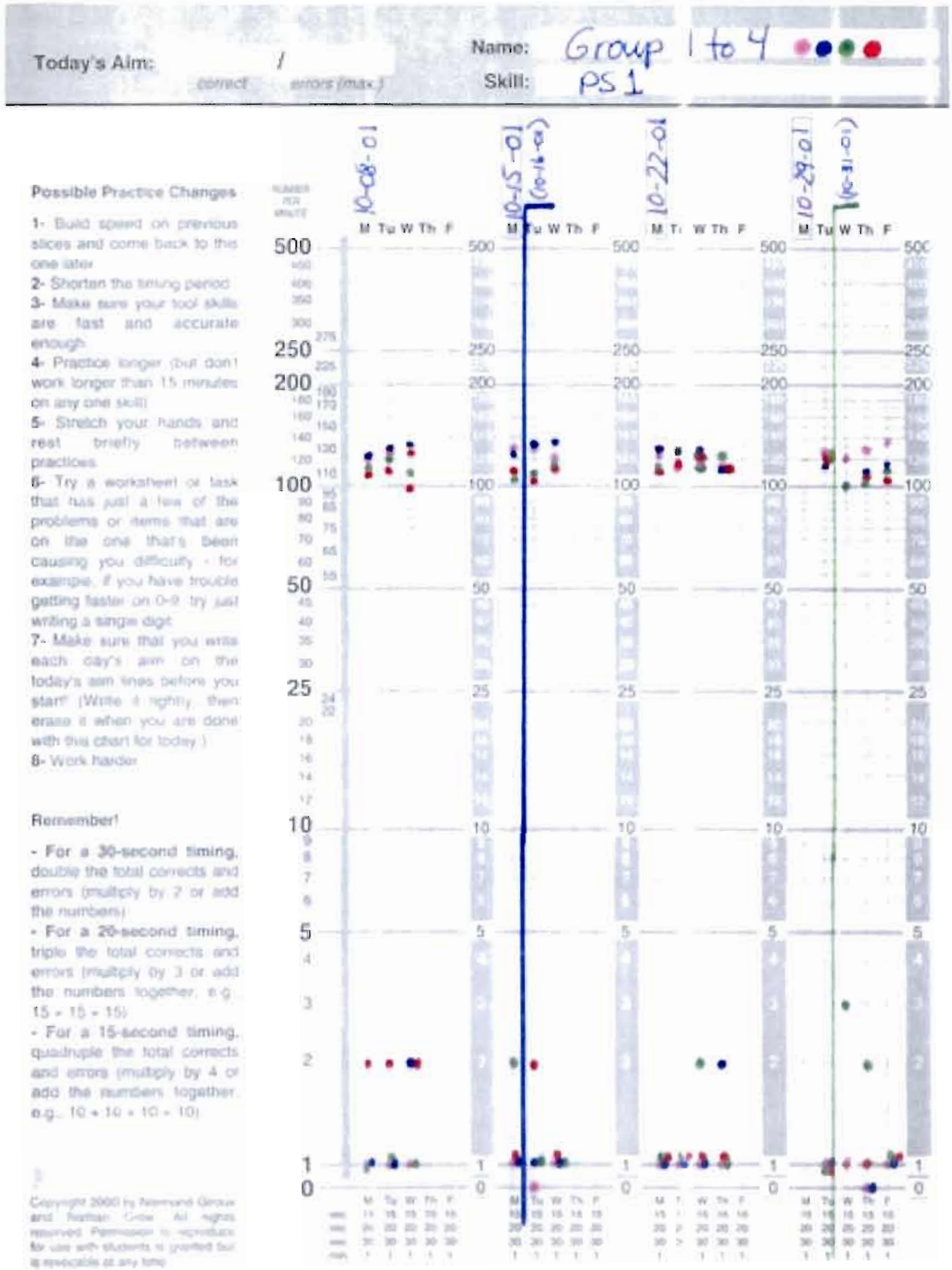


Figure 4 (3/4). SACC of Reading Frequencies for Classes 1 to 4 on Practice Sheet 1.

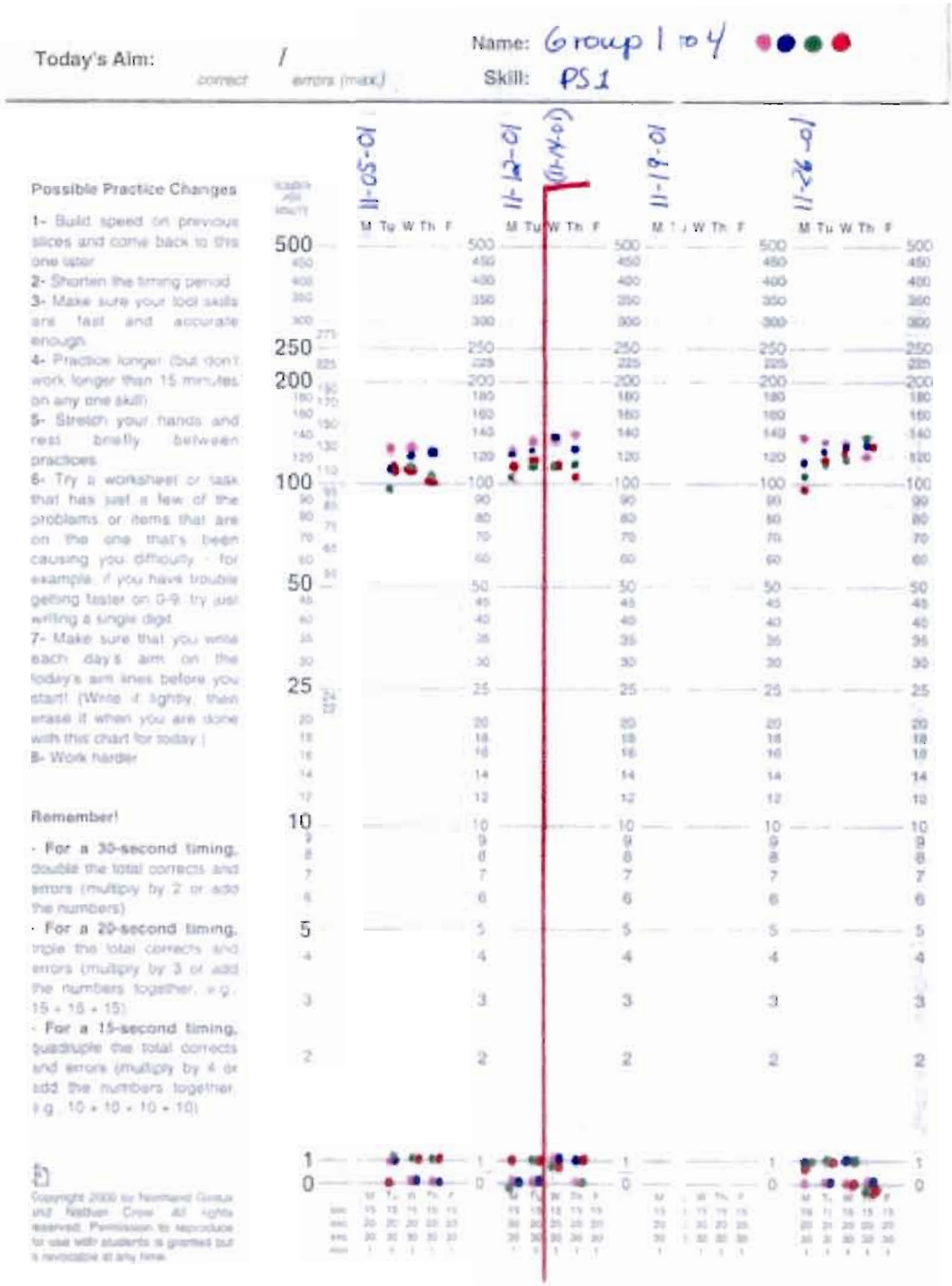


Figure 4 (4/4). SACC of Reading Frequencies for Classes 1 to 4 on Practice Sheet 1.

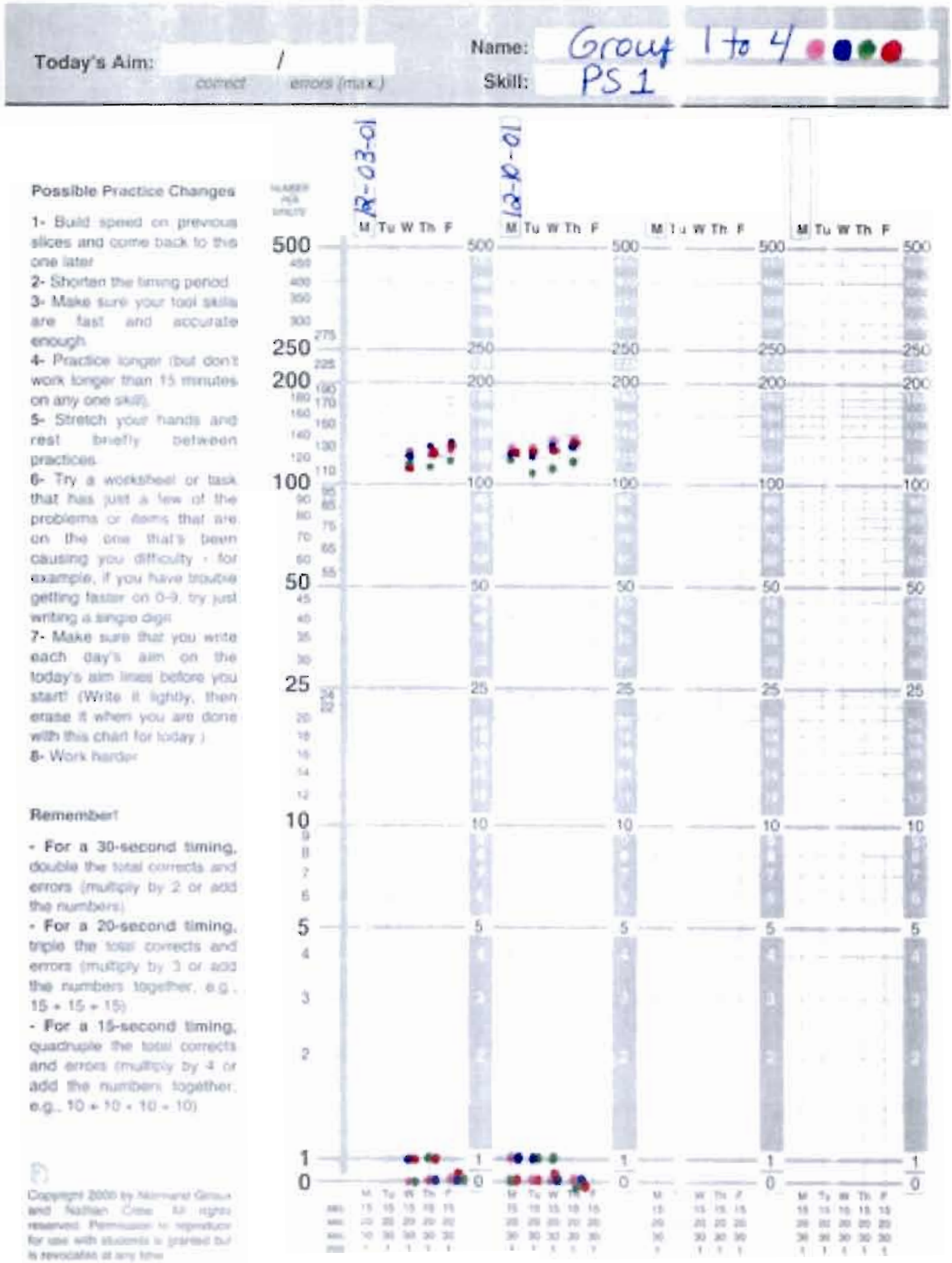


Figure 5 (1/4). SACC of Reading Frequencies for Classes 1 to 4 on Practice Sheet 2.

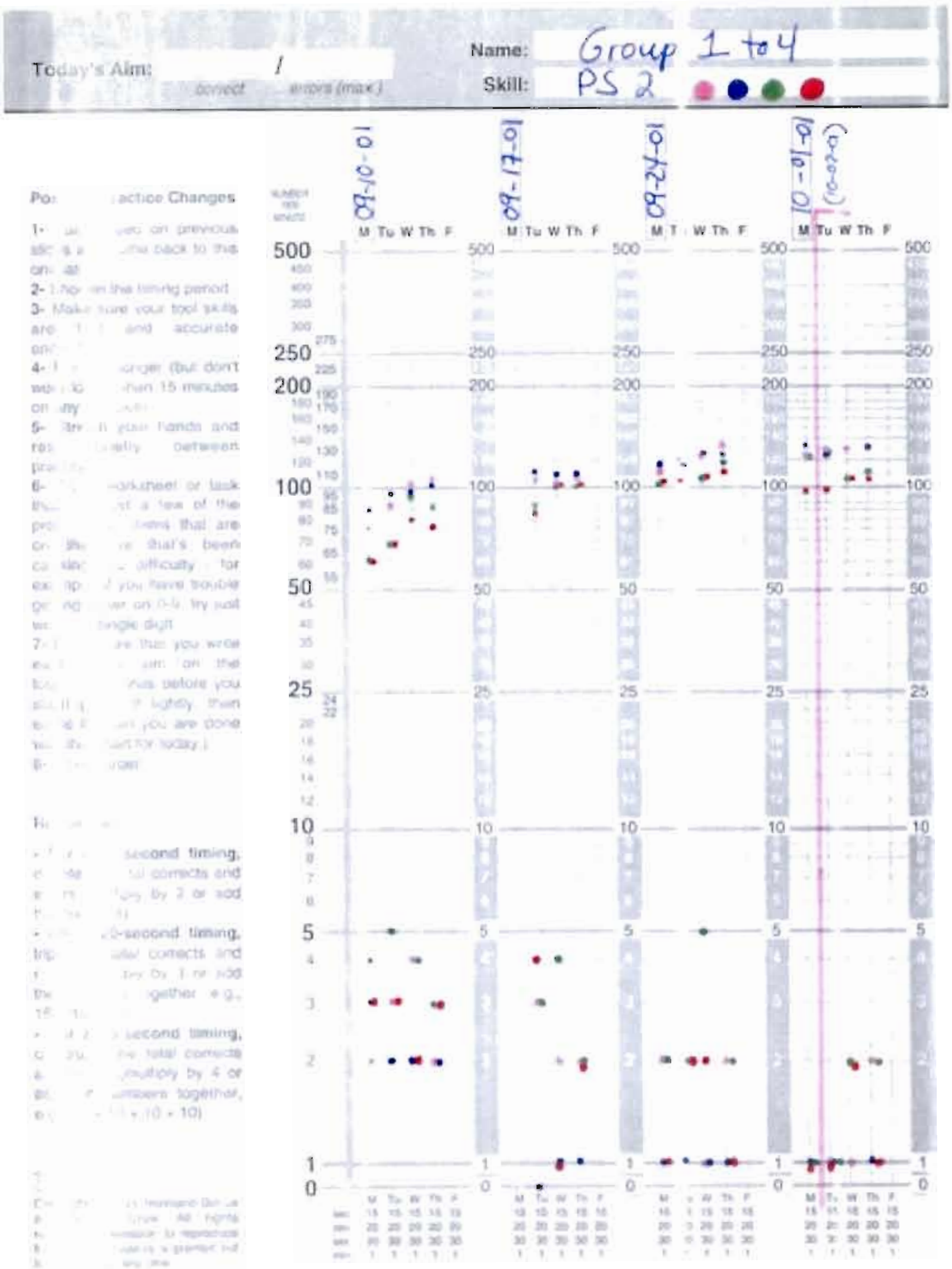


Figure 5 (2/4). SACC of Reading Frequencies for Classes 1 to 4 on Practice Sheet 2.

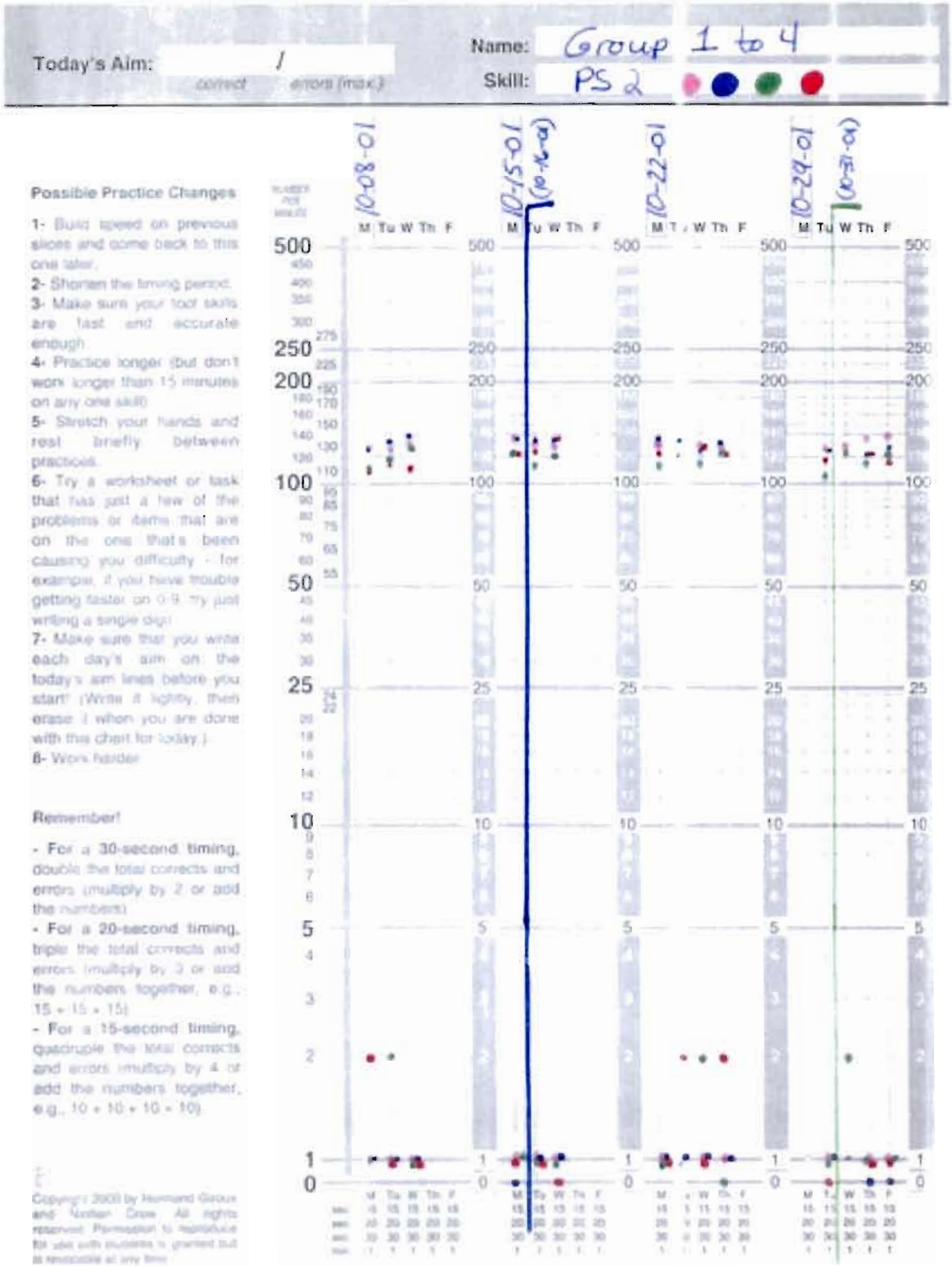


Figure 5 (3/4). SACC of Reading Frequencies for Classes 1 to 4 on Practice Sheet 2.

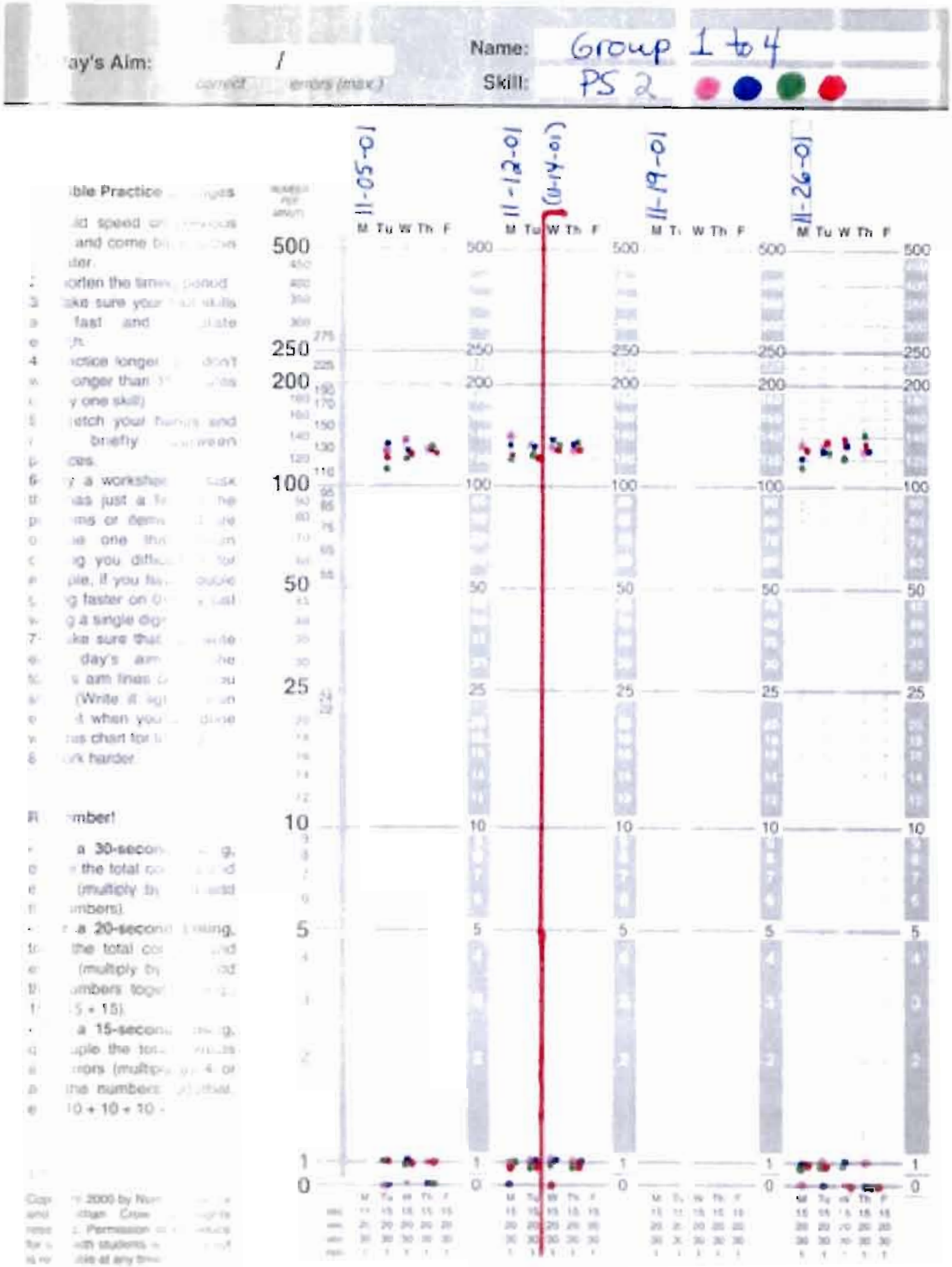


Figure 5 (4/4). SACC of Reading Frequencies for Classes 1 to 4 on Practice Sheet 2.

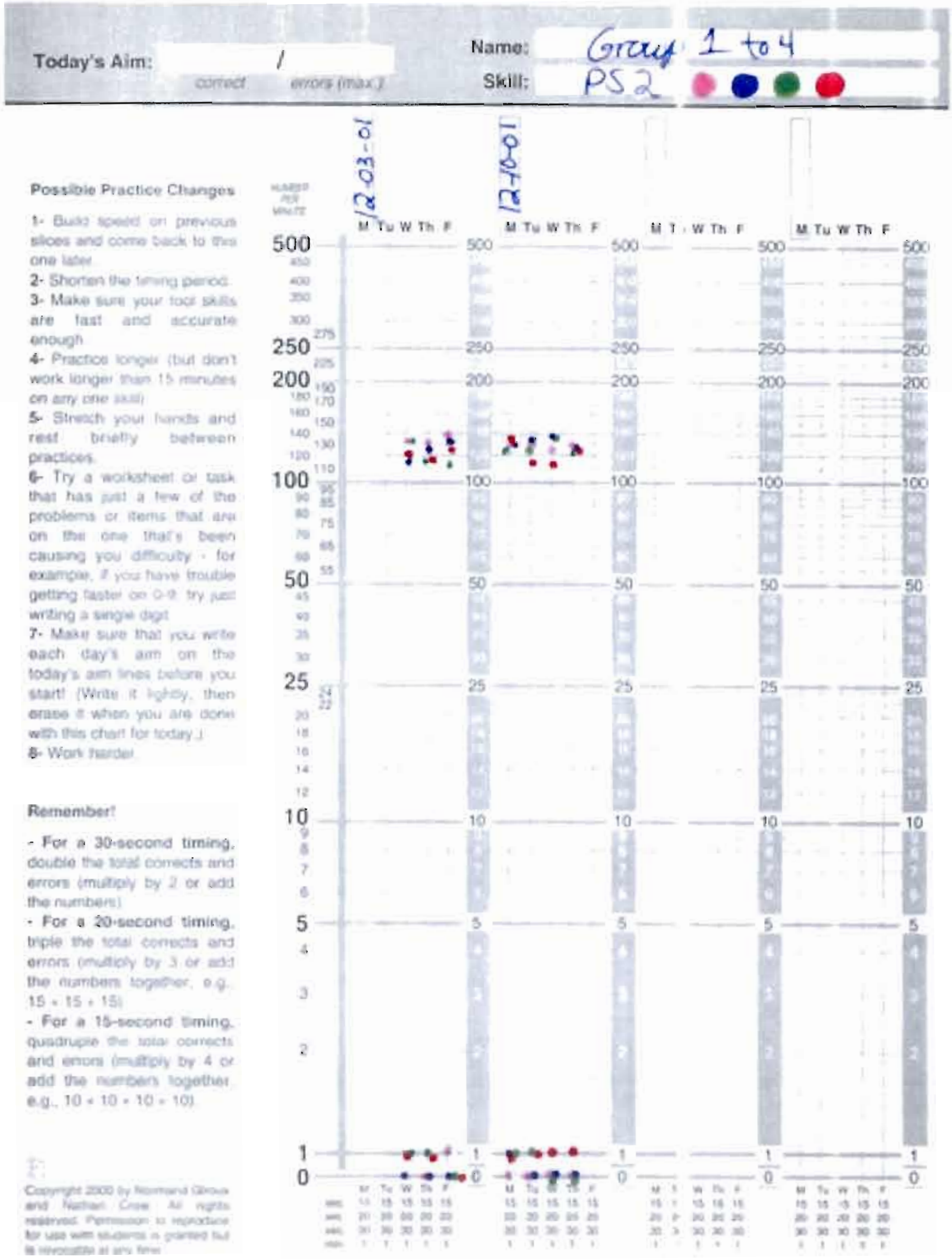


Figure 6(1/4). SACC of Reading Frequencies of Low and High Achievers on Practice Sheet 1.

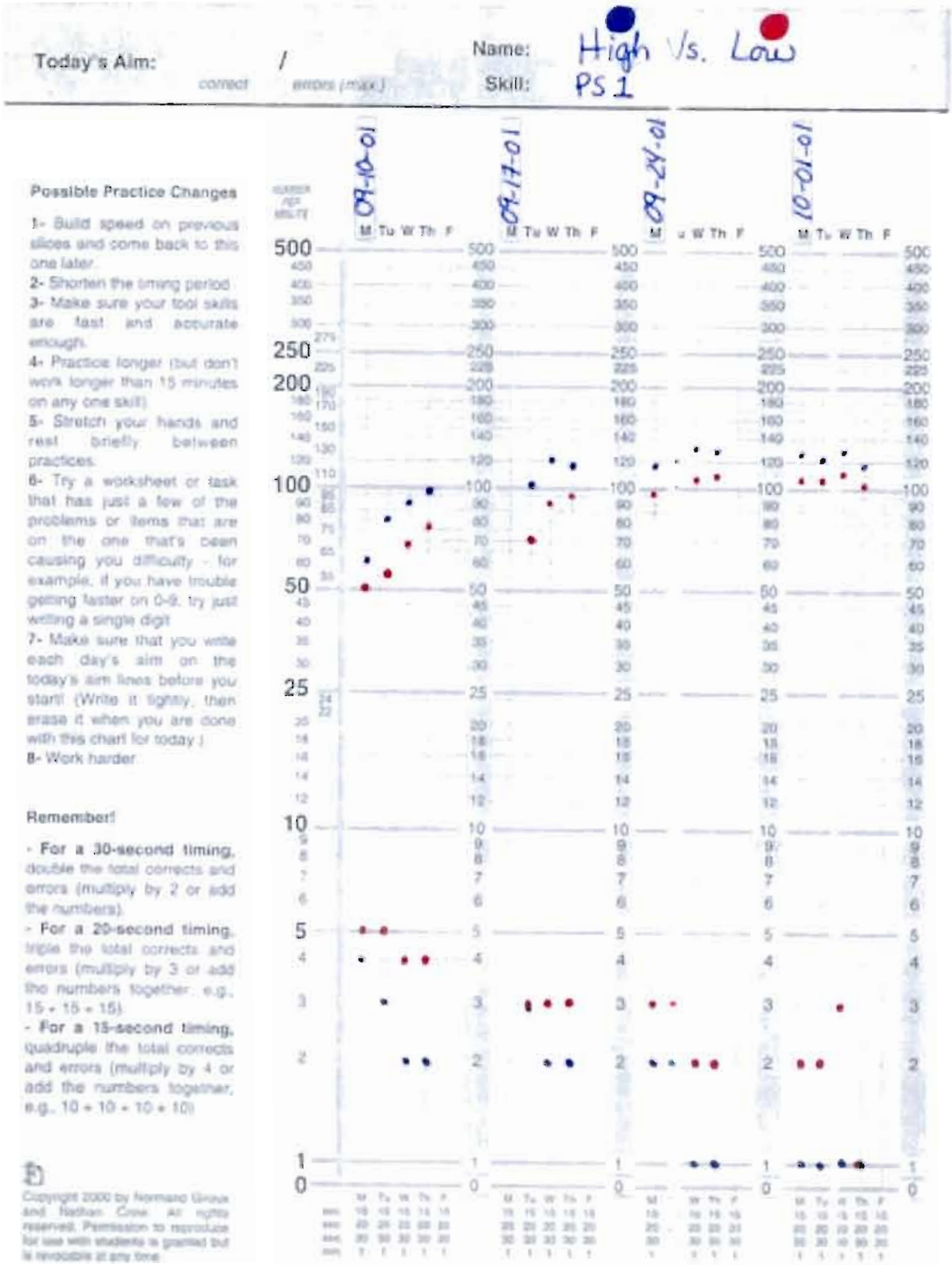


Figure 6(2/4). SACC of reading frequencies for low and high achievers on practice sheet 1.

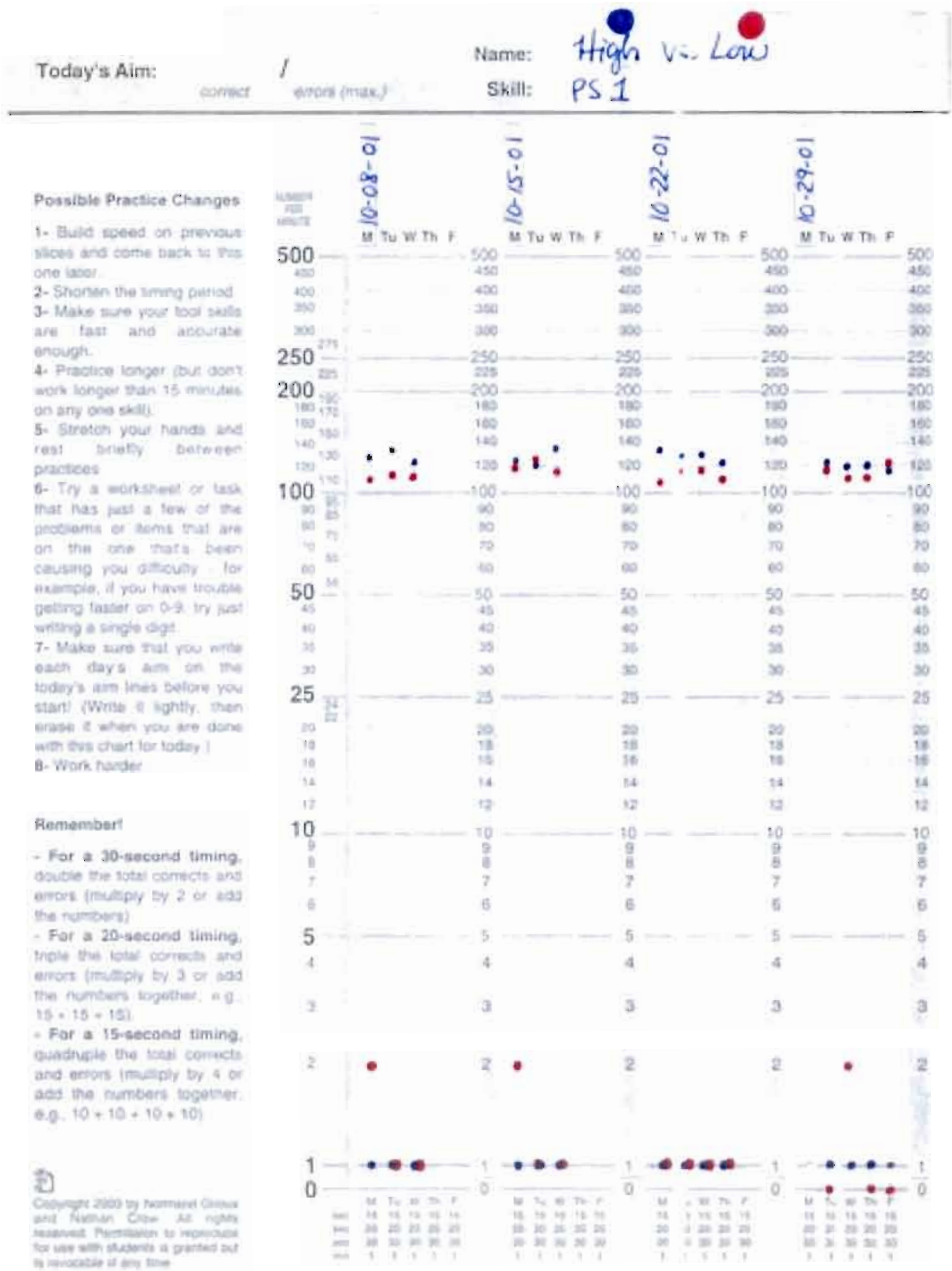


Figure 6(3/4). SACC of Reading Frequencies for Low and High Achievers on Practice Sheet 1.

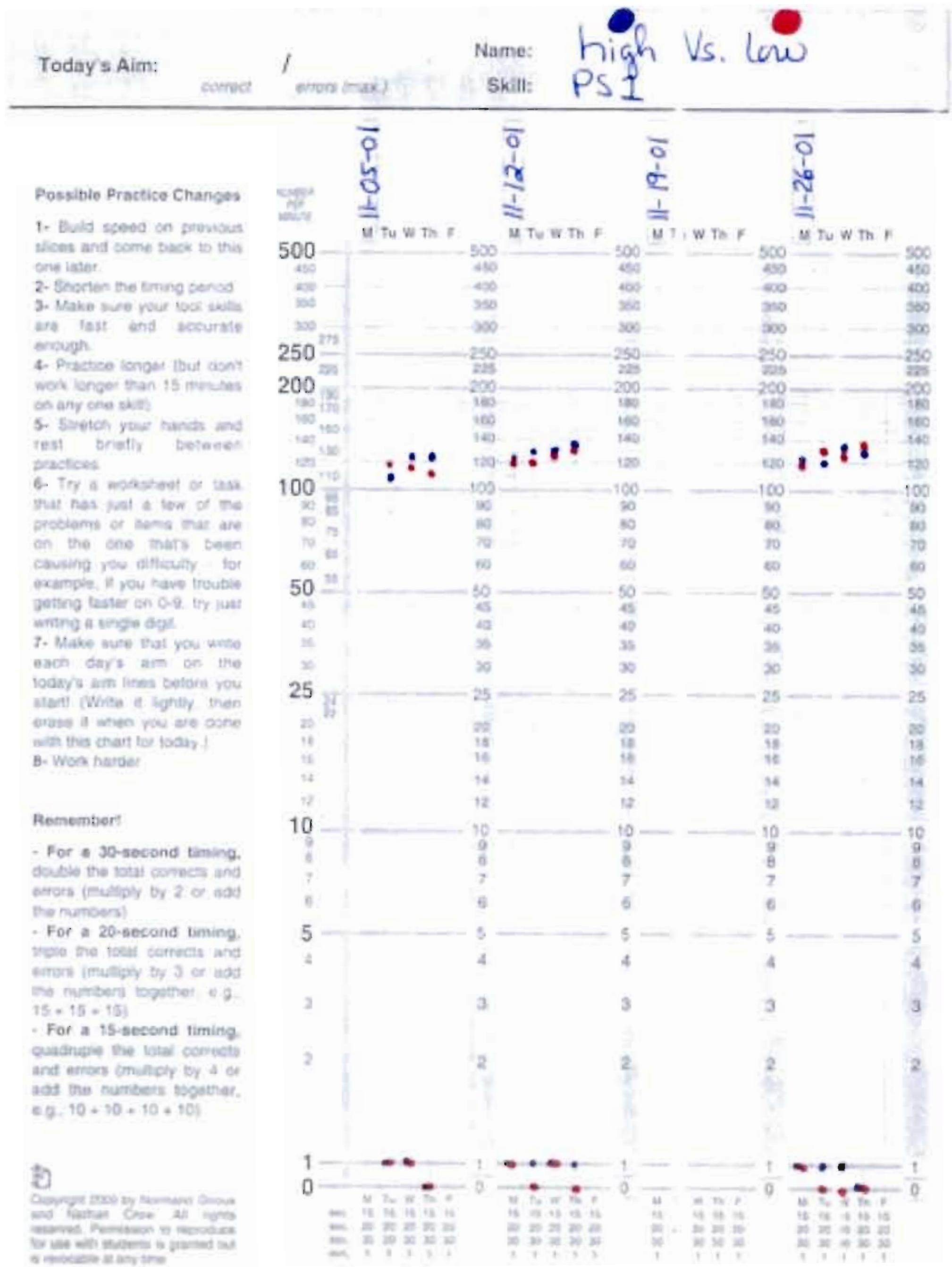


Figure 6(4/4). SACC of Reading Frequencies for Low and High Achievers on Practice Sheet 1.

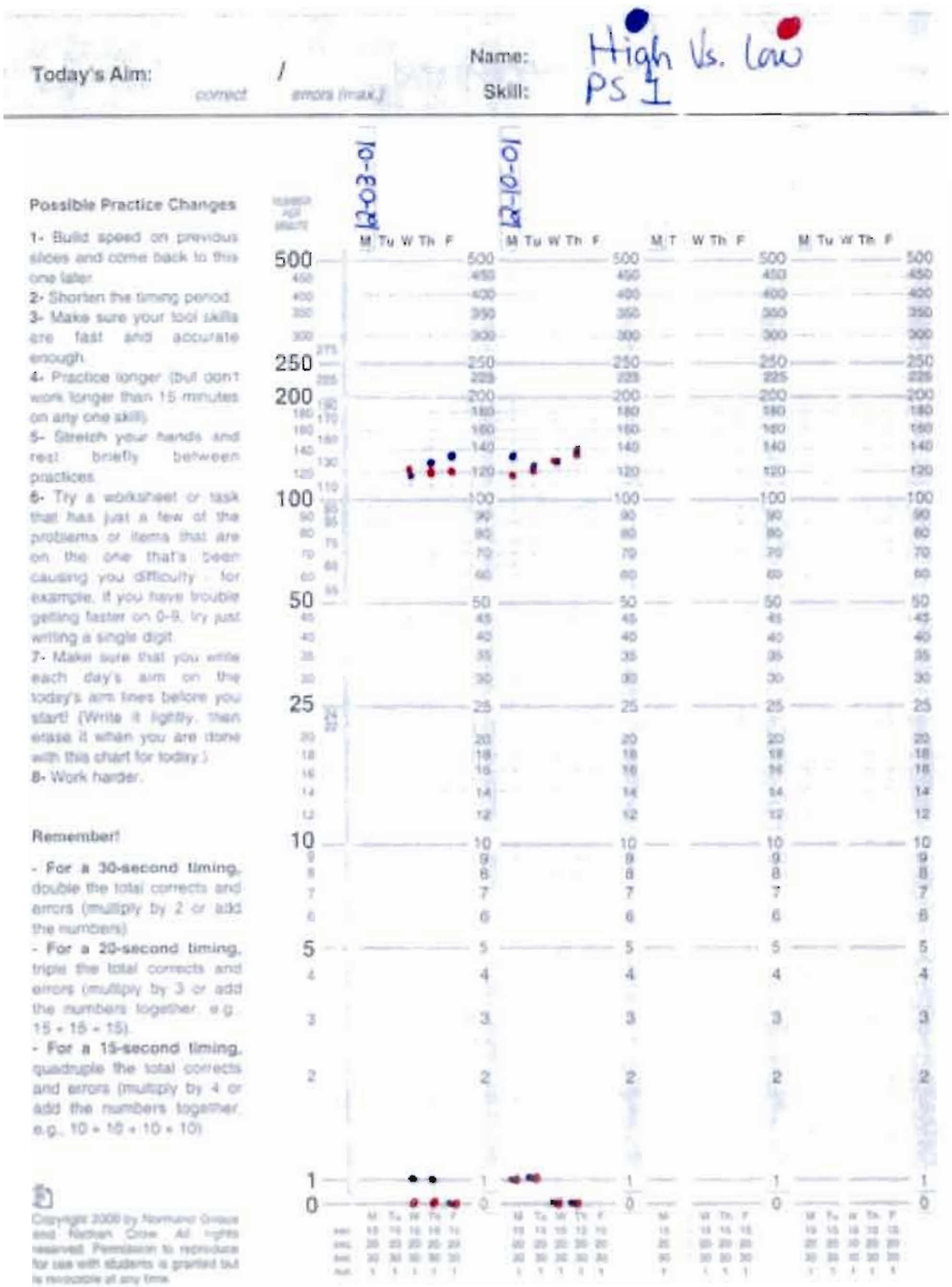


Figure 7(1/4). SACC of Reading Frequencies for Low and High Achievers on Practice Sheet 2.

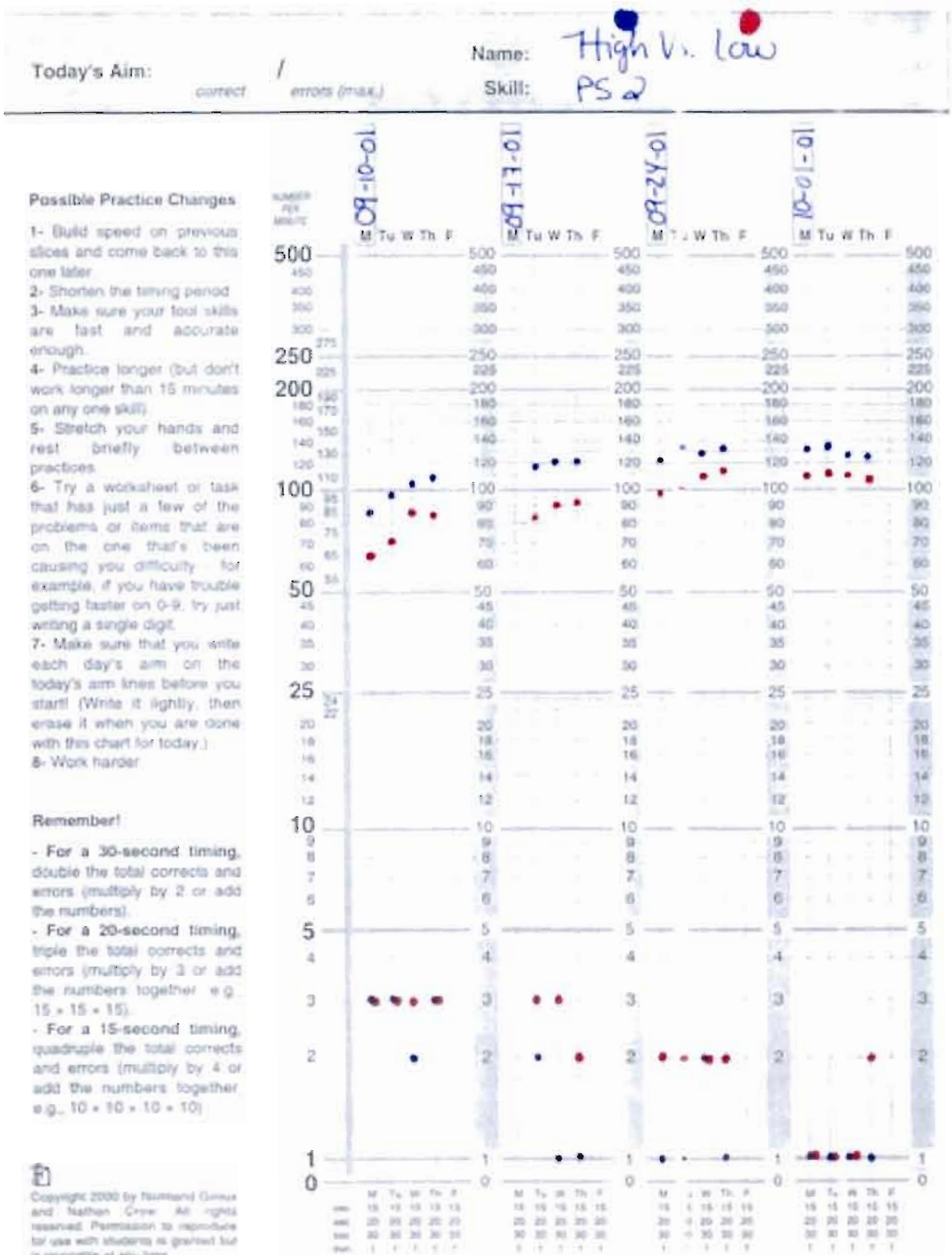


Figure 7(2/4). SACC of Reading Frequencies for Low and High Achievers on Practice Sheet 2.

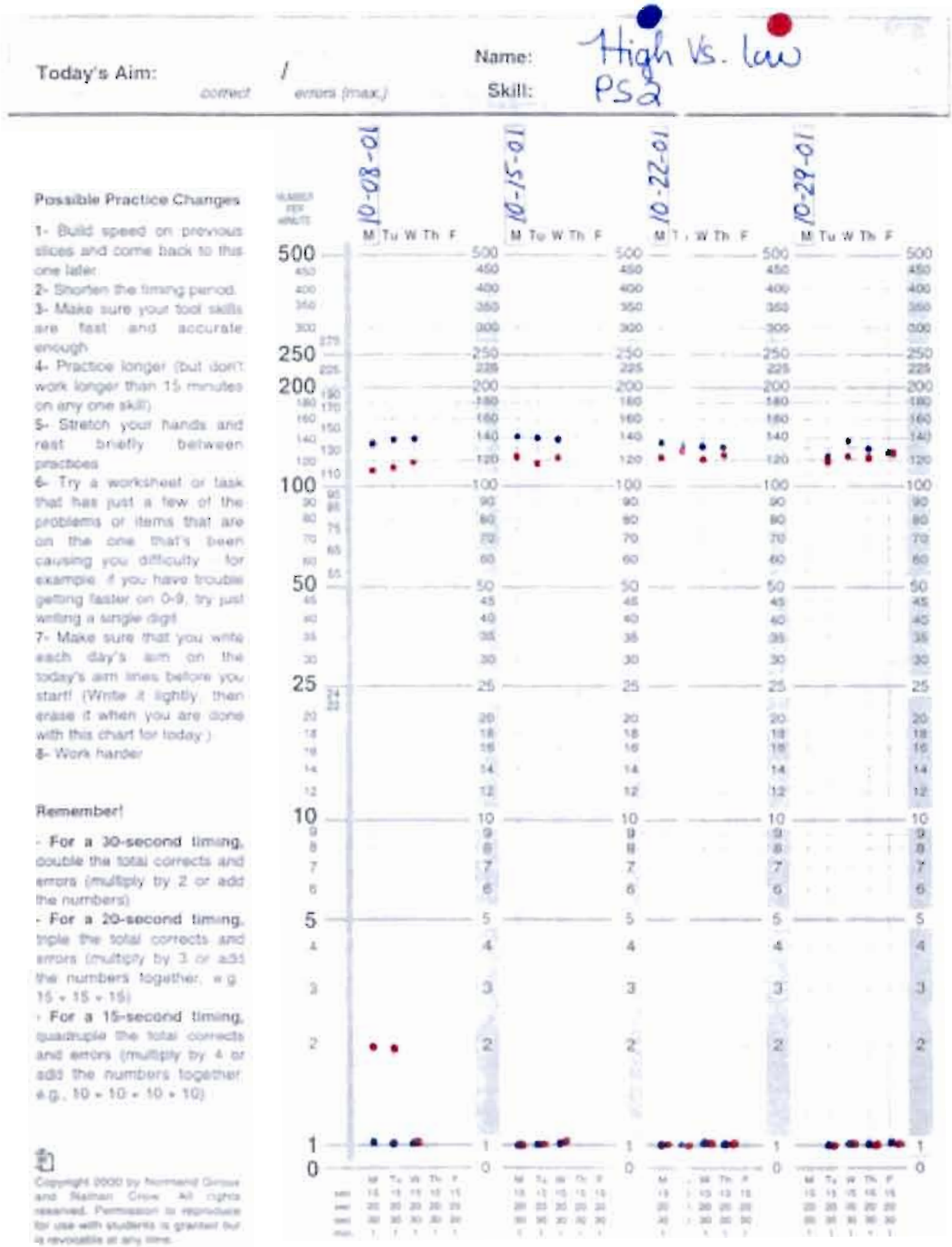


Figure 7(3/4). SACC of Reading Frequencies for Low and High Achievers on Practice Sheet 2.

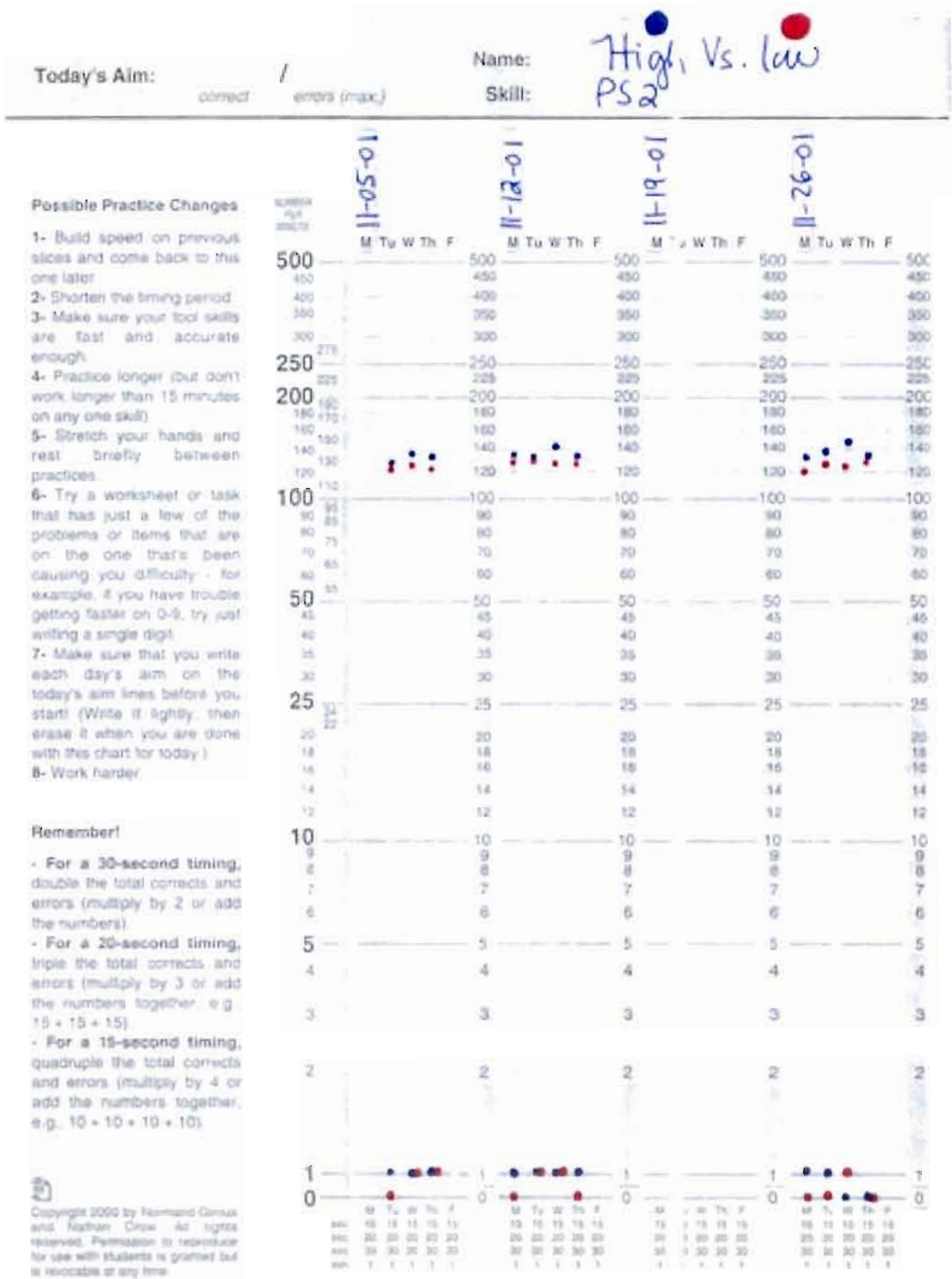
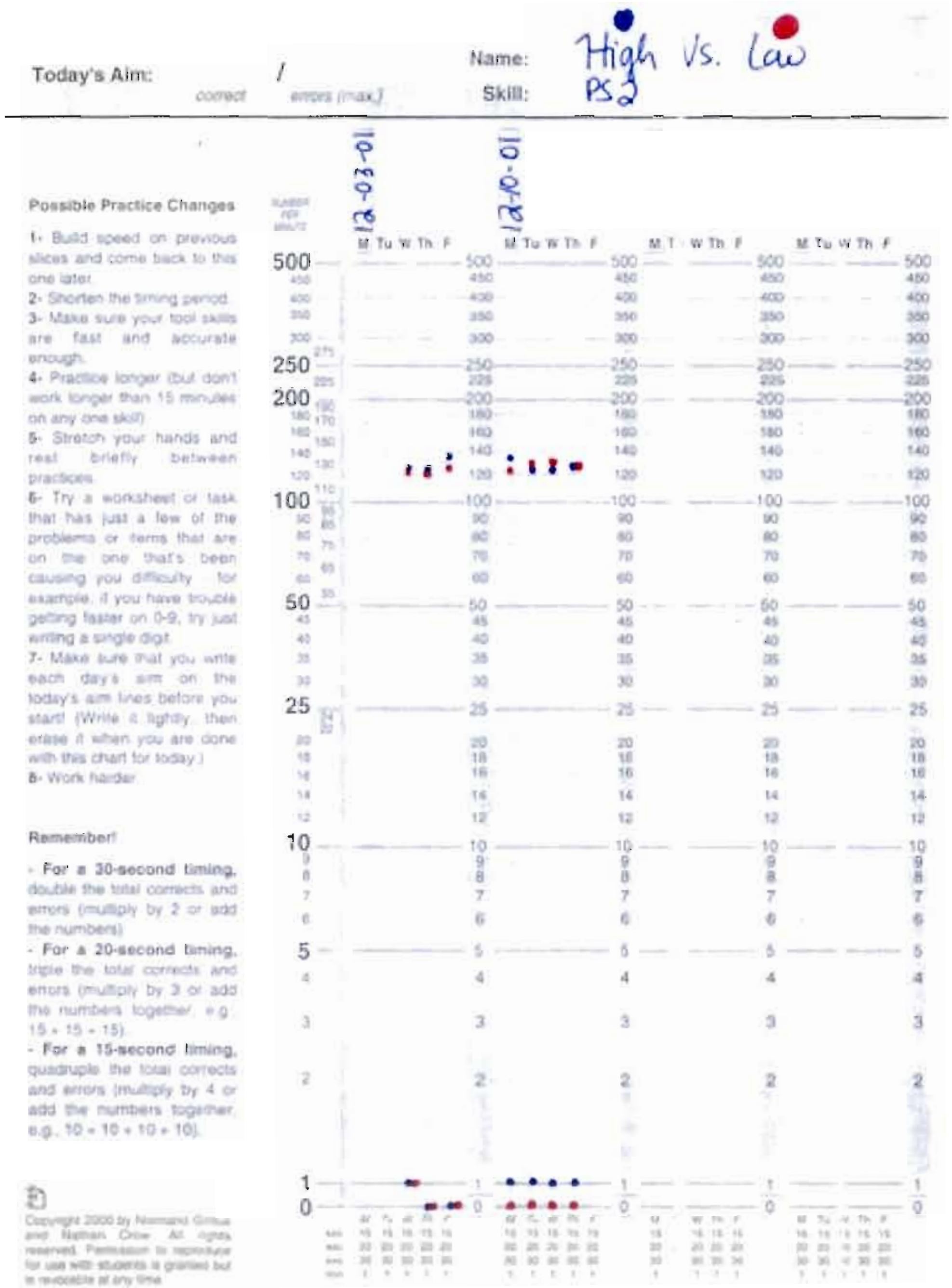


Figure 7(4/4). SACC of Reading Frequencies for Low and High Achievers on Practice Sheet 2.



CHAPITRE III

DISCUSSION ET CONCLUSION DE LA THÈSE

DISCUSSION GÉNÉRALE

L'objectif de cette thèse doctorale est l'étude de l'autogestion, plus précisément de l'autonotation du rendement scolaire, combinant l'enseignement direct et la didactique de précision. La thèse est composée de deux articles, le premier théorique et le deuxième empirique, précédés d'une introduction relativement élaborée. Le présent chapitre présente une synthèse des résultats de la recension des écrits scientifiques et de l'article empirique en tentant d'apporter un éclairage explicatif des derniers et des répercussions sur l'utilisation de la didactique de précision. Il résume ensuite les implications et limites de l'étude de la thèse. Des recommandations pour les recherches futures dans le domaine y sont proposées. La conclusion offre une vue critique de la réforme scolaire au Québec, communément désignée le *Renouveau Pédagogique*, en perspective des modèles d'enseignement explicite comme l'enseignement direct et la didactique de précision.

La didactique de précision et ses graphiques

La recension des écrits scientifiques, présentée au premier chapitre, a porté sur l'autogestion des apprentissages, plus précisément sur l'autonotation et l'auto-inscription graphique. L'objectif du premier article est de recenser et d'analyser les différents graphiques de la didactique de précision. Par l'intermédiaire de cet objectif, l'analyse critique a aussi comme buts de souligner les différentes caractéristiques des graphiques papiers et celles des graphiques informatisés, afin d'y déterminer les inconvénients et les avantages de chacun. Finalement, suit une discussion sur l'utilisation, le maintien et la promotion des procédures graphiques de la didactique de précision auprès des intervenants en éducations, des praticiens et chercheurs de la communauté scientifique en didactique de précision et dans les domaines connexes.

Les graphiques standards. Les graphiques standards de la didactique de précision sont ceux qui respectent les règles de l'échelle semi-logarithmique sur l'ordonnée (ratios de fréquences de comportements) et l'angle de 34 degrés sur la diagonale du graphique (Giroux, 2010; Giroux & Forget, 1996 ; Lindsley, 2010). Parmi ceux-ci, on y retrouve le *Standard Celeration Chart* (*SCC*), principal graphique et surtout celui le plus communément utilisé par les praticiens et les chercheurs dans le domaine (Pennypacker, Gutierrez, & Lindsley, 2003). Le graphique SCC a été créé par Lindsley (1972, 1990b, 1991, 2010). Il se trouve sous les formats pratiques de mesure des fréquences du comportement « quotidien » (angl. *daily SCC*), mensuel (angl. *monthly SCC*) et annuel (angl. *yearly SCC* ; Pennypacker et al., 2003). Le graphique standard quotidien SCC a un format papier paysage de 8 1/2 x 11. Sur une seule feuille, on y retrouve l'équivalent de la moitié d'une année scolaire. Un graphique de format affiche (angl. *poster*) de 24 x 36 pouces a aussi percé brièvement le marché (Beck, Conrad, & Gayler, 1994). Son grand format a certainement pu être intéressant pour les séances de communications (angl. *poster session*) à des congrès et pour des conférences, mais son utilisation en classe est très probablement limitée. En effet, la communication de l'évolution du rendement scolaire chez les élèves est considérée comme de l'information confidentielle (Daggett & Huefner, 2001) et certaines écoles évitent d'afficher publiquement ce genre d'information.

Les graphiques alternatifs. Les graphiques alternatifs sont des graphiques qui aux premiers abords respectent aussi les règles de base des graphiques standards : l'échelle semi-logarithmique sur l'ordonnée et l'angle de 34 degrés sur la diagonale du graphique. Cependant, l'empan fréquentiel est habituellement différent afin d'y agrandir l'effet visuel sur l'ordonnée. À cet effet, Berquam (voir Vargas, 2009) a créé un graphique dit simplifié (angl. *Simplified Chart)* permettant de noter des séances de lectures chronométrées (angl. *timings*) d'une minute ou moins. Ce graphique s'échelonne sur neuf semaines avec le même angle de 34 degrés sur la diagonale, mais conserve un format papier de 8 1/2 x 11pouces. Afin de rendre son utilisation plus accessible visuellement, Berquam accroît les espaces entre les lignes du graphique et amplifie seulement le haut du graphique (c.-à-d., là où les comportements devraient se retrouver le plus fréquemment). Alors que Vargas (2009) soutient que les enseignants préfèrent le graphique standard SCC et que les élèves trouvent plus facile d'utilisation le graphique *Simplified Chart*, aucune donnée empirique à ce sujet n'est mentionnée. Beck, Conrad, et Anderson (1999) ont créé un cahier d'exercices et un graphique à trois cycles, le *Timing Chart*, qui compte de un à 1000 comportements par minute, sur un total de 70 jours. Le cahier d'exercices a pour but de promouvoir le concept de la fluidité par la répétition rapide et précise de concepts appris à l'école. Le graphique est similaire au SCC mais avec une abscisse comptant les séances chronométrées plutôt que de suivre un calendrier scolaire. Cependant, ces graphiques qui s'éloignent du graphique standard SCC ne sont pas mentionnés dans les écrits scientifiques comme étant des graphiques alternatifs. Parmi les graphiques dits alternatifs de la didactique de précision proposés dans les écrits scientifiques, on y retrouve les *quatre graphiques alternatifs de Giroux et Forget* (1996). Ces quatre graphiques (les *Modules A à D*) offrent un apport visuel considérable au moyen de leur format papier portrait plutôt que paysage, de 81/2 par 14 et par leurs échelles fréquentielles raccourcies en comparaison au graphique standard. Le *Module A* (voir Figure 3), couvre un éventail de fréquences de 5 comportements par minute à 1000 comportements par minute. Le *Module B* (voir Figure 4) couvre un éventail d'un comportement par minute à 200 comportements par minute. De ces quatre graphiques, les *Modules A* et *B* sont d'intérêt particulier puisqu'ils ont été l'inspiration pour la création du graphique *Standard Alternate Celeration Chart* (*SACC* ; Giroux & Crow, 2000). L'échelle du graphique SACC (voir Figure 5), couvrant un éventail de fréquences de zéro à 500 comportements par minute, est adaptée pour les apprentissages scolaires comme les mathématiques et la lecture. Autres que l'échelle des fréquences de comportements, les apports du SACC sont : (a) l'ajout du zéro sur l'échelle de fréquences, (b) un retour au format papier 81/2 par 11, mais portrait plutôt que paysage comme dans le cas du graphique standard, (c) l'ajout de directives de la didactique de précision dans la marge de gauche et (d) un choix de temps d'exercices chronométrés (angl. *timings*) de 15, 20, 30 secondes et d'une minute. Le zéro fut ajouté après les demandes répétées des élèves de l'école où s'est déroulée l'expérimentation présentée au deuxième chapitre de la thèse. Tel que soulevé par Nathan Crow (communication personnelle, 15 août 2001), co-auteur du graphique alternatif SACC, les élèves trouvaient dommage d'avoir à mettre un point d'interrogation sous la ligne d'une fréquence par minute comme prescrit pour les graphiques standards (White & Haring, 1980), alors qu'ils n'avaient commis aucune erreur durant la minute d'exercices chronométrés (angl. *one-minute timing*).

Malgré l'agrandissement visuel que ces graphiques alternatifs procurent sur la lecture du graphique, un désavantage est l'espace requis pour exposer l'intervention au complet. Le SACC n'illustrant que quatre semaines par graphique, il serait nécessaire d'utiliser quatre graphiques SACC pour un seul graphique standard SCC pour illustrer une intervention identique. L'effet visuel de la progression d'un comportement est plus difficilement perceptible sur le graphique alternatif SACC, comparativement à l'effet visuel sur le graphique standard SCC, car il faut consulter plusieurs pages pour voir la portée d'une intervention. Ce problème est désagréable pour les élèves, les enseignants, les cliniciens, les praticiens et les chercheurs. Mais aussi pour les périodiques et les revues savantes qui voient leurs coûts-bénéfices diminués en publiant de nombreuses pages de graphiques.

Intérêt pour les graphiques standards et alternatifs

Une des raisons qui a motivé la création du graphique standard SCC était son aspect pratique. En effet, le graphique standard permettait des échanges facilités entre professionnels en utilisant le même outil de mesure, le même langage interprétant les mesures obtenues et ce, peu importent le type d'interventions effectuées, ou l'empan fréquentiel nécessaire au comportement ciblé. L'utilisation d'un seul graphique pour tous les domaines de recherche ou d'intervention est alors nécessaire. Ce graphique unique permet d'éviter les explications des échelles individuelles ou les particularités des différents graphiques utilisés lors de séances de partage de graphiques (angl. *chart-sharing sessions* ; Lindsley, 1972, 1990a, 1991, 2010). Le graphique standard SCC a établi une solide réputation dans le domaine de la didactique de précision et les graphiques alternatifs sont relativement nouveaux en comparaison des travaux originaux de Lindsley (1964). En fait, depuis sa création, 1 197 198 SCC ont été utilisés jusqu'à l'an 2000 (Calkin, 2002a). Le graphique standard est utilisé surtout par les praticiens et chercheurs en didactique de précision et il est le seul graphique publié dans la revue officielle de la société de la didactique de précision, le *Journal of Precision Teaching and Celeration*. Ces nombreux éléments peuvent expliquer partiellement le manque d'engouement pour les graphiques alternatifs en pratique, recherche et publication.

Les raisons rapportées en ce qui a trait à la préférence du graphique standard SCC vs les graphiques alternatifs sont majoritairement les suivantes : (a) la disposition visuelle des fréquences de comportements sur une longue période de temps, (b) les lignes indicatrices de changements dans l'intervention et (c) la facilité de trouver sur le graphique un jour d'école sur l'abscisse standardisée avec le calendrier scolaire régulier (Born, 2001). Born (2008) écrit sur le SC*listserv*: "And there is a 'don't knock it until you try it' aspect, too. People just have to be willing to work with standardization for a while before they can understand the power", ce qui démontre à quel point il y a une certaine résistance à utiliser les graphiques alternatifs de la didactique de précision. Born questionne aussi la position d'autorité que prendra la personne qui nommera ces graphiques alternatifs découlant du graphique standard. En réponse, Shewmaker (2008) écrit : "Who has the right to name what those charts are, Scott wants to know, and what should that name be? This is a problem of nomenclature and classification, as well as defining the authority to speak with some degree of conclusiveness." Les propos de Shewmaker suggèrent un malaise qui semble plus profond qu'une simple question de nomenclature; ils se réfèrent au changement, à l'évolution des standards établis depuis près de 50 ans en didactique de précision. La résistance est dans la pratique – l'utilisation du graphique standard SCC par rapport à l'utilisation de tous autres graphiques alternatifs – et dans la réticence de partager un nom commun et similaire avec d'autres graphiques que le SCC. Pourtant, Shewmaker continue avec d'autres propos qui ramènent la question sur la nomenclature sans toutefois toucher au malaise plus profond de changement : "What we can certainly do is specify the differences, and we can specify just how close the other charts, including non-paper electronic charts, come to the "standard" set by the paper chart." Le graphique papier (angl. *paper chart*) auquel l'auteur fait référence est le graphique standard SCC. Le malaise et l'insatisfaction concernant quelque modification que ce soit au graphique standard SCC est palpable dans ce message écrit par Verplanck (1998) sur le SC*listserv* :

> To change such a standard form of communication would seem to be very disruptive unless the original standard has proven faulty, the change produces a major correction, is still clearly relatable to the original standard and is generally accepted and then used by all in that community. The way the posts favoring revision of the chart read, they seem to ask for some sort of short-cut, or easy way, to record behavior; they do not propose a clear alternative to the standard chart.

Giroux et Forget (1996) rapportent un faible taux de maintien de l'usage du graphique standard SCC par des orthopédagogues. Les enseignants se plaignent du manque de convivialité du graphique standard SCC dans la classe. La convivialité du graphique est ici définie par une apparence visuelle attrayante et une utilisation facile de ses procédures. Selon Giroux et Forget, les graphiques alternatifs furent développés afin de remplir un besoin de convivialité dans l'utilisation des outils de la didactique de précision. Les graphiques alternatifs n'ont pas été créés pour s'éloigner des standards de la didactique de précision, mais plutôt pour contribuer à l'évolution d'un outil puissant. Les graphiques alternatifs partagent les mêmes caractéristiques de base que le graphique standard SCC. De plus, Born (2001) mentionne sur le SC*listserv* qu'il n'hésiterait pas à implanter le graphique alternatif auprès des enfants qui ne comprennent pas les variables motivationnelles et les aspects techniques du graphique standard. Le graphique alternatif SACC pourrait donc servir de tremplin pour l'utilisation du graphique standard, ce qui va à l'encontre des propos de Maloney (1998) sur la facilité pour les enfants d'utiliser le graphique standard SCC.

Finalement, les principaux graphiques alternatifs sur le marché permettent un agrandissement visuel des pentes de célération, mais, en contrepartie, ils nécessitent plus d'espace pour exposer l'intervention comparativement à une seule page pour le graphique standard SCC. Peut-être que les graphiques informatisés répondront à la fois aux besoins d'agrandissement visuel et de facilité d'analyse d'un plus grand éventail de taux de réponses de comportements, sans toutefois augmenter l'espace requis pour illustrer une intervention ?

Les graphiques informatisés

Quelques graphiques informatisés ont su capter l'attention des praticiens et des chercheurs en didactique de précision. Les graphiques *Excel-based Standard Celeration Charts*, le *Judge Rotenberg Center Exclusive Celeration Chart* et récemment le *Electronic Modified Standard Daily Chart*.

L'*Excel-based Standard Celeration Chart* a été créé par Harder (1998) en utilisant le logiciel Excel. Il permet d'avoir à l'écran un graphique standard SCC et d'accéder aux statistiques de la didactique de précision. Aucune nouveauté n'a été ajoutée à ce graphique. Le *Judge Rotenberg Center Exclusive Celeration Chart*, un graphique informatisé créé par Péladeau (2001) exclusivement pour le centre permet de transformer le graphique quotidien en graphique hebdomadaire, mensuel et annuel. Schuessler et Forget (2009) ont mené une étude sur l'auto-inscription graphique par des élèves ayant un trouble du spectre de l'autisme et leurs enseignants, en utilisant une adaptation francophone de ce graphique (Péladeau, 2003). Finalement, on retrouve l'*Electronic Modified Standard Daily Chart* (*EMSDC*) de Regli et collègues (2010a, 2010b). Ce graphique respectent toutes les caractéristiques du graphique standard SCC (p. ex., l'échelle semi-logarithmique sur l'ordonnée et l'angle de 34 degrés sur la diagonale du graphique). Sans permettre une transformation du graphique journalier en graphique hebdomadaire, mensuel ou annuel, il permet l'agrandissement de sections du graphique pour une meilleure inspection visuelle. Le graphique EMSDC permet aussi d'inscrire une *ligne de célération minimale* (c.-à-d., une ligne indiquant l'amélioration souhaitée) déterminée par l'utilisateur, afin de proposer des directives pour toutes interventions auprès des élèves. Les analyses statistiques de la didactique de précision se calculent automatiquement. Ces statistiques sont : (a) la *performance* (c.-à-d., moyenne de fréquences de comportements par minute) ; (b) la *précision* (c.-à-d., moyenne de fréquences des réponses exactes divisée par la moyenne des fréquences des réponses exactes et erronées, multipliée par 100 pour l'obtention d'un pourcentage) ; (c) la *célération* (c.-à-d., la droite de régression indiquant le changement et sa direction) et (d) l'*indice d'amélioration globale* (c.-à-d., un résumé de la variance résiduelle exprimée avec un pourcentage). Cette dernière statistique, l'indice d'amélioration globale, offre une vue de l'amélioration résiduelle provenant de l'intervention. Cette statistique n'est pas offerte par les statistiques habituelles de la didactique de précision. Visuellement attrayant et facile d'utilisation, ce graphique semble prometteur pour les chercheurs et praticiens de la didactique de précision.

Analyse des graphiques papiers et des graphiques informatisés

Les graphiques informatisés de la didactique de précision ont été créés pour les buts de faciliter la collecte des données, l'entreposage sécuritaire des données et le partage de celles-ci. L'automatisation des procédures graphiques et des calculs statistiques de la didactique de précision ne rend pas seulement la didactique de précision plus accessible à tous, mais aussi réduit le temps nécessaire à son utilisation. Surtout lorsque la didactique de précision est utilisée avec un grand groupe d'élèves, par exemple.

Même si les graphiques informatisés offrent des avantages comparativement aux graphiques papiers, ils ont été critiqués de ne pas conserver un angle stable en les imprimant, selon les logiciels utilisés (Calkin, 2004). Cependant, ce problème spécifique de stabilité de l'angle de 34 degrés sur la diagonale du graphique n'a jamais été rapporté, ni observé dans le manuel de l'utilisateur du EMSDC (Regli et al., 2010a). Il ne se trouve pas non plus dans d'autres publications.

Le Tableau 1 du premier article de la thèse offre une vue comparative des graphiques papiers vs les graphiques informatisés. Ce tableau permet l'examen d'une liste d'avantages et de désavantages reliés à la fois aux produits et aux procédures de la didactique de précision. Plusieurs aspects sont scrutés et comparés du format papier au format informatisé, par exemple, les options offertes, les statistiques, le partage d'information, la tenue de dossier des données brutes pour la recherche, la manipulation et l'entreposage des graphiques et les choix éco-environnementaux. Les graphiques informatisés n'offrent pas tous les mêmes avantages et options (voir Tableau 1). Cependant, le tableau comparatif suggère la supériorité de la pratique graphique informatisée sur tous les aspects et ajoute, entre parenthèses, les exemples spécifiques de graphiques où les spécifications s'appliquent. Par exemple, le Tableau 1 montre que des statistiques supplémentaires (et non traditionnelles à la didactique de précision), comme la Célération Minimale et l'Indice d'Amélioration Globale, se retrouvent sur le graphique EMSDC. Comme le graphique EMSDC est le graphique le plus récent sur le marché et qu'il offre le plus d'avantages en comparaison avec tous les autres graphiques disponibles de la didactique de précision, il ne devrait pas être surprenant que ce dernier soit prisé. Toutefois, un avantage que les graphiques papiers ont sur les graphiques informatisés, c'est la possibilité d'écrire ou de dessiner des notes directement sur les graphiques, une option qui n'est pas (encore) disponible pour les graphiques informatisés.Un des problèmes relié à l'utilisation du graphique standard SCC est son partage avec la communauté en ligne ; un graphique papier doit être numérisé puis attaché en document au courriel envoyé sur le SC*listserv*. La qualité visuelle du document numérisé dépend alors de l'équipement électronique et de l'écriture à la main du praticien, chercheur ou de l'élève.

Finalement, la reconnaissance d'un besoin pour les graphiques non seulement alternatifs mais aussi informatisés procurera l'occasion d'étudier en profondeur l'utilisation et le maintien des pratiques de tous les graphiques en didactique de précision ainsi que de nouvelles perspectives sur la pratique de l'auto-inscription graphique. Il est toutefois légitime de se demander en quoi l'informatisation des procédures de la didactique de précision augmentera son usage auprès des praticiens et chercheurs ?

Explications du peu d'intérêt pour la didactique de précision

Les réticences fondamentales à la didactique de précision semblent beaucoup plus profondes que les contraintes liées aux exigences techniques de son utilisation. Que le temps alloué aux procédures soit raccourci par l'utilisation d'un logiciel informatique, ne permet pas de croire que cela pourra nécessairement augmenter le nombre d'utilisateurs. Cela dit, l'utilisation de la didactique de précision représente un effort, voire une tâche pour les enseignants (Giroux & Forget, 1996 ; Schuessler & Forget, 2009). Luria (2009) se demande sur le SC*listserv* quel problème sera résolu par la didactique de précision ? Il ne semble pas évident pour les enseignants de faire un lien entre les informations graphiques de la didactique de précision et le cheminement pédagogique à emprunter (Giroux, 2010). Nonobstant les avantages décrits par plusieurs auteurs sur l'autonotation et l'auto-inscription graphique (DiGangi et al., 1991 ; Gunter et al., 2002 ; Lindsley, 1990a, 2010 ; Moxley, 2007 ; Rock, 2005 ; Sutherland & Snyder, 2007), il n'en demeure pas moins que les enseignants délaissent les procédures de la didactique de précision, même informatisée, au bout de quelques semaines (Giroux & Forget, 1996; Schuessler & Forget, 2009).

Le partage de graphiques entre praticiens et chercheurs est un élément important de la didactique de précision (Lindsley, 2010). Cependant, tel que mentionné par Merbitz (2008), les discussions sur le SC*listserv* ne contiennent pas beaucoup de ce type de partage:

> (...) I would be very interested in seeing more presentations of charts with questions posed by the charter, and followed by input from the list, and then follow-up from the charter with what happened next, etc. I think that opportunities for advancement of science via Internet networking are being missed.

Donc, la question n'est plus seulement relative à l'accessibilité de partager des graphiques entre praticiens et chercheurs, mais concerne plutôt l'intérêt de partager les graphiques en tant que tel.

Le *Journal of Precision Teaching and Celeration* a été créé en 1980 afin de publier le graphique standard SCC qui était refusé ailleurs par des périodiques en analyse appliquée du comportement (Lindsley, 2010). Selon Lindsley, le graphique standard SCC était jugé trop difficile à comprendre et peu esthétique pour les éditeurs :

> Editors also eschew Standard Celeration Charts primarily because the data usually do not fill the chart space but are way up near the top, or way down along the bottom, or

> clustered in a little worm-like bunch at one end of the chart space. Standard charts immediately communicate the frequency, celeration, bounce, and duration of the data, but do not aesthetically please the eye trained to admire data stretched to fill chart space. (p. 51).

Le *Journal of Precision Teaching and Celeration* se trouve sur le moteur de recherche Internet populaire *Google Scholar*, mais ne se trouve pas sur les bases de données *EBSCOhost*, *JSTOR*, psycARTICLES, et *PubMed Central CA*. Et seulement neuf articles du *Journal of Precision Teaching and Celeration* se retrouvent sur *ERIC*, la plus grande base de données en éducation. Des 9 articles trouvés, 5 impliquent le même auteur (Fabrizio, Schirmer, King, Diakite, & Stovel, 2007 ; Lefebre, Fabrizio, & Merbitz, 2008 ; Schirmer, Almon-Morris, Fabrizio, Abrahamson, & Chevalier, 2007 ; Weiss, Fabrizio, & Bamond, 2008 ; Zambolin, Fabrizio, Ferris, Barclay, & Carrier, 2007). Subséquemment, il est pertinent de se demander si les auteurs de la didactique de précision font tous les efforts pour faire connaître leur publication ou de publier ailleurs que dans ce périodique isolé et peu connu des chercheurs des domaines connexes. Un besoin de commercialisation 101 (angl. *marketing 101*) se fait sentir par la modeste popularité de l'utilisation de la méthode ; comment être sérieusement considérée quand la revue est très peu structurée non seulement dans ses échéanciers, mais aussi dans le nombre d'articles publiés annuellement?

Les types de pratiques scientifiques sont différentes des moeurs généralement connues – la didactique de précision maintient un climat de partage d'étude de cas entre praticiens et a peu de soucis pour la recherche scientifique classique et pour la compréhension du jargon utilisé, en dehors du milieu de pratique, dans l'utilisation de cet outil éducationnel. La didactique de précision a été développée surtout dans des classes d'écoles publiques et l'information disséminée à travers des ateliers de formation des enseignants (Lindsley, 2010). Selon Lindsley, comme la formation à la didactique de précision passe par une tradition de communications orales, les spécialistes formés ont été peu encouragés à publier dans des périodiques. Le ratio des communications orales pour chaque publication est d'environ 3:1.

Ces éléments ne sont pas incitatifs à la découverte et à l'utilisation de la didactique de précision, à moins d'être déjà convaincu.

L'auto-inscription graphique à l'aide du *Standard Alternate Celeration Chart*

L'étude empirique de la thèse, présentée au deuxième chapitre, est une analyse quantitative de la fluidité en lecture d'élèves de septième et huitième année dans une école du Colorado, aux États-Unis. L'objectif premier de la recherche empirique est d'examiner les effets de l'auto-inscription graphique de la fluidité en lecture de phonèmes francophones lus par minute à l'aide du *Standard Alternate Celeration Chart*. Pour réaliser cet objectif de recherche, des élèves de classes de français comme langue seconde ont ajouté la pratique de l'auto-inscription graphique aux activités régulières de la classe, en suivant un devis de recherche à niveaux de base multiples. Le deuxième objectif de cette étude est de déterminer s'il y a des différences dans la fluidité en lecture de phonèmes francophones lus par des élèves typiques présentant un rendement scolaire faible comparativement à des élèves typiques présentant un rendement scolaire plus élevé, utilisant le graphique *Standard Alternate Celeration Chart.*

Les résultats de l'étude empirique

Le premier objectif de la recherche empirique est l'examen des effets de l'auto-inscription graphique de la fluidité en lecture de phonèmes francophones lus par minute à l'aide du *Standard Alternate Celeration Chart*. Pour évaluer cet objectif, deux types d'analyses statistiques sont utilisées. Les analyses statistiques de la didactique de précision (c.-à-d., les pentes de célération) et les analyses statistiques classiques (p. ex., moyennes, écart-types, intervalles de confiance, ANOVA et test-*t*).

Les statistiques classiques et les statistiques de la didactique de précision. Dans l'examen des effets de l'auto-inscription graphique de la fluidité en lecture de phonèmes francophones à l'aide du graphique SACC, les résultats de l'étude empirique rapportent des résultats intéressants quant à l'autogestion du rendement scolaire. Les résultats indiquent que les participants lisent de façon plus fluide les phonèmes francophones durant la phase de traitement plutôt que durant le niveau de base. En effet, les analyses classiques de moyennes de phonèmes francophones lus par les élèves sont significatives (voir Tableau 2 de l'article 2).

Contrairement aux analyses classiques, les différents indices mesurant la *performance* et le progrès des participants, qui représentent des analyses propres à la didactique de précision, démontrent une stagnation des apprentissages durant les deux phases (voir Tableau 3 de l'article 2) . Ces différents indices sont : (a) le débit moyen des réponses (angl. *response rate*), (b) le coefficient de célération (c.-à-d., la mesure du changement en cours lors d'une même phase), (c) le coefficient d'apprentissage (c.-à-d., la mesure du rapport entre deux coefficients de célération de deux phases consécutives) et (d) l'indice d'amélioration globale (c.-à-d., qui correspond au coefficient d'apprentissage traduit en pourcentage, rendant ainsi l'indice plus convivial ; Giroux & Lévesque, 2001). Seules, les analyses de la didactique de précision telles qu'utilisées dans cette étude ne permettent pas une analyse juste du rendement en lecture de phonèmes francophones par les élèves. L'autogestion du graphique, en tant que tel, semble démontrer peu d'effet sur le rendement des élèves, contrairement aux résultats et aux attentes rapportés par Lindsley (1971, 1990a, 2010).

Même si les coefficients de célération de l'auto-inscription graphique de la qualité d'exécution des élèves sur le graphique SACC ne démontrent que peu d'effet sur le rendement scolaire de ceux-ci, l'auto-inscription graphique permet l'observation d'une image globale de l'apprentissage des élèves depuis le premier jour de l'expérimentation. Ainsi, le graphique SACC sert le même but en didactique de précision que la radiographie sert en radiologie–un regard sur l'évolution du rendement des élèves, mais ne semble pas les influencer dans le cas présent. On pose alors un diagnostic et on note l'évolution.

Différences entre les pentes de célération et les statistiques classiques. Même si les résultats de l'étude en ce qui a trait à aux effets de l'auto-inscription graphique sur le rendement en lecture de phonèmes francophones ne montrent que peu d'effet sur la *performance*, il n'en reste pas moins que les statistiques classiques démontrent des effets significatifs. Il ne s'agit pas ici de se prononcer sur un très vieux débat dans le domaine de l'analyse du comportement relative aux types de méthodologies et de statistiques qu'il faille privilégier. En effet, depuis la fin des années 50, avec l'apparition du *Journal of the Experimental Analysis of Behavior* (en 1958), du volume classique de Sidman (1960) sur la méthodologie de recherche que doit respecter toute recherche en analyse du comportement et dix ans plus tard avec l'apparition du *Journal of Applied Behavior Analysis* (en 1968), il est clair que la discipline a choisi et défendu son orientation. Les statistiques inférentielles classiques indiquent peu de choses utiles sur le comportement individuel (Bloom, Fisher, &

Orme, 2009; Johnston & Pennypacker, 1993 ; Poling, Methot, & LeSage, 1995). Cela ne signifie pas que, pour d'autres types d'études ou bien dans le cadre d'autres disciplines, les statistiques inférentielles soient inutiles. Au-delà de ce que certains pourraient croire de la position sectariste de l'analyse du comportement et des recommandations des meilleures pratiques en matière d'évaluation comportementale telle que pratiquée en didactique de précision (Moran & Malott, 2004), la présente étude a toutefois tenté d'analyser les données par l'intermédiaire de techniques classiques de statistiques inférentielles. Dans le cadre général de la didactique de précision, les statistiques classiques ne sont pas utilisées ; se prononcer sur la valeur de l'une ou l'autre ne fait aucunement partie des objectifs de la présente recherche. Mais pour l'analyse du comportement, le débat est clos, que ce fait soit apprécié ou non.

Pour ce qui est de la comparaison de la didactique de précision à d'autres méthodes d'enseignement des langues secondes, rappelons que la didactique de précision est une méthode d'évaluation et non une méthode d'enseignement, en dépit de la confusion pouvant provenir du terme anglais *precision teaching*. De plus, la didactique de précision n'a jamais été comparée à d'autres méthodes d'évaluation comportementale comme l'analyse fonctionnelle expérimentale (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982 ; Iwata, Duncan, Zarcone, Lerman, & Shore, 1994) ou l'analyse multimodale du comportement (Gardner, 2002), ou à d'autres méthodes d'évaluation non-comportementale. Cependant, comme le proposent Hayes et Follette (1992), il serait impératif d'évaluer la validité relative et l'intérêt de ces différentes méthodes d'évaluation. Notons que la présente étude ne poursuivait pas cet objectif. Ce travail reste donc à faire non seulement dans le cadre de l'enseignement des langues secondes, mais aussi bien de manière beaucoup plus générale en éducation, en psychologie clinique et en réadaptation.

Comparaisons des niveaux de rendement scolaire. Le deuxième objectif de l'étude empirique est de déterminer s'il y a des différences dans la fluidité en lecture de phonèmes francophones lus par des élèves typiques présentant un rendement scolaire faible comparativement à des élèves typiques présentant un rendement scolaire plus élevé, utilisant le graphique *Standard Alternate Celeration Chart*. Quoique les élèves présentant un rendement scolaire faible obtiennent des résultats moins élevés durant les phases du niveau de base et du traitement que les élèves présentant un rendement scolaire plus élevé, leur amélioration est toutefois plus de deux fois plus élevée que l'amélioration des derniers. Ces résultats sont en accord avec ce qui est rapporté dans les écrits scientifiques de l'Enseignement Direct (Becker, 1992; Watkins & Slocum, 2004). À la connaissance des chercheurs, aucune étude en didactique de précision n'a comparé les élèves qui présentent un rendement scolaire faible aux élèves présentant un rendement scolaire plus élevé. De plus, ces résultats confirment la nécessité pour les élèves présentant un rendement faible de recevoir un enseignement structuré, tel qu'il est offert par l'enseignement direct et la didactique de précision (Adams & Engelmann, 1996 ; Rosenshine, 1986, 2009). Il est possible qu'il y ait un plafond comportemental non pas en raison du matériel d'enseignement utilisé (c.-à-d., les feuilles d'exercices), mais bien à la capacité physique de l'appareil phonétique humain. Donc possiblement que les élèves présentant un rendement scolaire plus élevé atteignent un présumé plafond comportemental plus rapidement que les élèves présentant un rendement scolaire plus faible. Ils ne peuvent plus s'améliorer non pas par capacité individuelle, ou par l'efficacité de la stratégie d'enseignement. Cette situation permet aux élèves qui présentent un faible rendement scolaire de rejoindre le rendement scolaire plus élevé des autres élèves.

Implications et limites de l'étude de la thèse

Le fait que ce soit la première fois que le graphique SACC soit utilisé dans le cadre d'une recherche empirique, que la didactique de précision soit appliquée au français comme langue seconde et qu'une comparaison soit effectuée entre des élèves typiques présentant un faible rendement scolaire et des élèves présentant un rendement scolaire plus élevé, contribuent à l'originalité de cette thèse. La pertinence de cette recherche se retrouve dans l'évaluation des effets de l'auto-inscription graphique sur le rendement des élèves et dans l'intérêt pour les différences retrouvées auprès des élèves typiques présentant un faible rendement scolaire comparativement aux élèves typiques qui présentent un rendement scolaire plus élevé, utilisant une combinaison d'enseignement direct et de didactique de précision. Ainsi, cette thèse représente une innovation dans le domaine de la didactique de précision de l'enseignement en langue française.

Des limites concernant la généralisation des résultats sont notées. Avant tout, il est nécessaire de mentionner le caractère particulier de l'échantillon : les élèves connaissent et utilisent le graphique SACC régulièrement dans les autres cours que le français comme langue seconde. Il est donc possible de penser que les élèves ont déjà une carte cognitive de ce à quoi ressemble le progrès attendu d'eux sans avoir commencé à noter leur rendement sur le graphique.

Aucun curriculum sur le marché n'offre des activités phonétiques pour des élèves apprenant le français comme langue seconde. Le matériel d'enseignement à donc été créé par la chercheure, en collaboration avec l'enseignante du cours de français comme langue seconde, inspiré du matériel de Borel-Maisonny (Sylvestre de Sacy, 2000). Il s'agit ici de phonèmes francophones, mais il aurait pu s'agir de chiffres et nombres, de catégories d'objets ou même de figures sans signification, comme il est de tradition de le faire lors de procédures d'équivalence du stimulus utilisées en analyse appliquée du comportement (Sidman, 1994). Le choix des tâches utilisées pour l'expérimentation s'est fait en fonction des champs d'intérêts de la classe de français comme langue seconde. Cependant, les tâches proposées aux élèves se sont avérées similaires. Chaque feuille d'exercices de phonèmes francophones n'offrait pas des tâches progressant en niveaux de difficulté et il semble que la répétition des tâches devenait triviale pour les élèves. Il est donc difficile de déterminer si l'effet de la didactique de précision, comme reconnu dans les écrits scientifiques, est attribuable à son utilisation en tant qu'outil d'évaluation ou non (Binder, 1988, 1996 ; Giroux & Lévesque, 2001 ; Lindsley, 1972, 1990a, 1990b, 1991, 1992, 1997, 2010 ; West & Young, 1992 ; White, 1986 ; White & Haring, 1980).

Malgré les instructions de non-divulgation des activités reliées aux lectures chronométrées et aux procédures graphiques auprès des élèves par l'enseignante, il est possible de croire qu'elles ont été partagées entre les élèves des différentes classes des niveaux de base multiples. La diffusion du traitement (Martella, Nelson, & Marchand-Martella, 1999) est donc aussi une possibilité à considérer dans l'affaiblissement de la variable indépendante puisque l'école est petite (environ 500 élèves répartis en neuf années scolaire et dans plusieurs classes ; Littleton Preparatory Charter School, 2011) et que tous les élèves se connaissent.

Plusieurs problèmes se sont posés concernant cet ambitieux projet de recherche mené par une étudiante dans le cadre d'une thèse doctorale. Par exemple, il y a les contraintes de l'école et celles d'une classe. L'école n'était pas équipée d'ordinateurs accessibles aux élèves et n'avait pas le budget nécessaire pour le faire. Il était donc hors de question d'instaurer des procédures graphiques informatisées avec les participants de la recherche. Cette situation s'est avérée problématique puisqu'elle a engendré beaucoup de manipulation physique des graphiques papiers par les élèves, l'enseignante et la chercheure durant l'étude. La qualité des informations recueillies sur les graphiques était aussi amoindrie par les habiletés en écriture et la propreté de chaque élève, ce qui aurait pu être évité par l'utilisation d'un logiciel informatique et de graphiques informatisés.

Pour ce qui est des contraintes d'une expérimentation en classe, la structure des groupes (p. ex., l'assignation des élèves dans les quatre classes d'enseignement du français comme langue seconde) est aménagée par la direction. Dans le cas présent, les élèves étaient regroupés en fonction de leurs habiletés en lecture en anglais. Cette répartition des élèves à donc généré une homogénéisation intragroupe des élèves, ce qui n'est pas un problème en soi. Cependant, cette répartition a aussi augmenté l'hétérogénéité intergroupe, rendant les quatre classes plus difficiles à comparer, ce qui peut se révéler plus problématique dans le cadre d'un devis de recherche à niveaux de base multiples.

Grâce à la coopération particulière de la direction de l'école, l'expérimentation a pu se faire plus volontiers dans le contexte de la classe de français langue seconde. Le contexte de la classe ordinaire, en raison des ses nombreux éléments restrictifs (p. ex., le respect du curriculum de l'Enseignement Direct et du temps alloué pour chaque leçon), ne permettait pas d'effectuer une étude empirique d'une telle ampleur. Dans le cas des autres classes (p. ex., classes ordinaires de l'enseignement de la lecture, de l'écriture, des mathématiques, etc.) les contraintes dues au respect du curriculum et des pratiques pédagogiques établies à l'école, cette étude n'aurait pu être. En fait, l'objectif de l'étude empirique n'était pas de faire une expérimentation dans un contexte d'apprentissage du français comme langue seconde, mais plutôt d'évaluer les effets de l'auto-inscription graphique à l'aide du graphique SACC. Le cours de français comme langue seconde de l'école en question, étant plus flexible dans son curriculum et dans le temps alloué aux différentes activités de la classe, a permis une intégration plus facile de l'expérimentation.

Recommandation pour les recherches futures

Des recherches futures, utilisant des tâches peu similaires et offrant un plus large éventail de qualité d'exécution des tâches entre elles permettraient de mieux déterminer si l'effet de la didactique de précision, comme il est reconnu dans les écrits scientifiques, est attribuable à son utilisation en tant qu'outil d'intervention (Beck, 1979 ; Beck & Clement, 1991 ; Binder, 1988, 2004 ; Lindsley, 1971, 1972, 1991, 1992, 2010 ; Olander et al., 1986 ; White & Haring, 1980). Et ce, tout en évitant d'atteindre un plafond comportemental.

Dans un contexte idéal, cette étude empirique utiliserait dès le départ le logiciel Cocon (Regli et al., 2010a, 2010b), le plus récent logiciel informatique pour la didactique de précision sur le marché. Ce logiciel offre une analyse plus détaillée, plus fine et une meilleure accessibilité visuelle des graphiques de la didactique de précision. Puisque le contexte serait idéal, tous les élèves participants auraient accès à un ordinateur. L'auto-inscription graphique se ferait directement à l'écran, permettant de consulter des données qui ne furent pas disponibles durant la présente expérimentation (p. ex., les pentes de célération). Évidemment, il est difficile de reprocher à une étude, peu importe le domaine abordé, de ne pas avoir utilisé des instruments ou des procédures qui n'existaient au même de l'expérimentation.

Finalement, il serait intéressant de reproduire l'étude de Vitale et Kaniuka (2009) au Québec auprès des enseignants et aussi auprès des professeurs universitaires. Vitale et Kaniuka ont simulé un processus décisionnel d'évaluation du programme d'appoint de lecture *Corrective Reading* (Engelmann et al., 1999b) en vue de l'adoption de celui-ci dans des écoles. Les 21 participants de leur étude, des enseignants du primaire, ont eu 50 minutes pour évaluer le programme de lecture et répondre à un questionnaire développé par les chercheurs. Des 21 enseignants, neuf ont recommandé le programme de lecture, sept l'ont refusé, et cinq se sont prononcé indécis et ont dit avoir besoin de plus de temps pour prendre une décision éclairée. Malgré les neuf recommandations, les faiblesses perçues du programme de lecture par tous les enseignants se retrouvent parmi les principes fondamentaux de ce qui rend le programme efficace (Engelmann & Carnine, 1991). Ces perceptions erronées rendent donc incertaine la fidélité d'une éventuelle implantation du programme. Il est inquiétant de constater que lors d'une réforme scolaire, des enseignants sont engagés dans le processus décisionnel de l'adoption d'un curriculum en lecture ou tout autre enseignement. Les enseignants, tout comme les administrateurs des écoles, ne possèdent pas nécessairement les connaissances adéquates pour poser un jugement basé sur les résultats de recherches empiriques. Cela dit, la reproduction de l'étude de Vitale et Kaniuka (2009) au Québec permettrait d'explorer les perceptions des enseignants (et de tous autres professionnels de l'éducation) quant aux besoins des élèves et d'évaluer le processus décisionnel de ceux-ci, en contexte de réforme scolaire.

Conclusion

Étant donné le contexte d'expérimentation aux États-Unis et la quasi-absence (voire totale absence, sauf pour Boyer, 1993, 2010) de l'enseignement direct et de la didactique de précision dans les écoles québécoises, les données de l'étude ne permettent certainement pas de comprendre pourquoi ces deux méthodes sont si peu connues et utilisées au Québec. Cependant, en se basant sur les résultats de l'étude de Vitale et Kaniuka (2009), une question s'impose : qui enseigne aux enseignants les résultats de l'étude *Follow Through*, la plus vaste étude sur l'efficacité des modèles éducationnels aux Etats-Unis ? En effet, ces résultats sont très peu disséminés à travers le monde de l'éducation (Watkins, 1997). Pourquoi l'enseignement direct et la didactique de précision sont-ils si peu adoptés en éducation, particulièrement dans les contextes éducatifs francophones ? Parce que la formation des enseignants passe par une éducation universitaire (Forget, sous prese) et qu'il est bien difficile de demander aux enseignants de connaître et d'utiliser une méthode qui ne leur est pas enseignée. C'est comme demander aux élèves d'être responsable de leurs propres apprentissages. En fait, c'est bien ce que la réforme de l'éducation, actuellement nommée *Renouveau pédagogique* (Minisère de l'Éducation, du Loisir et du Sport, 2005), endosse en mettant l'accent sur des méthodes centrées sur l'élève plutôt que sur des méthodes centrées sur les enseignants, comme le sont l'enseignement direct et la didactique de précision. Au sujet du *Renouveau pédagogique*, Van Neste (2000) écrit dans la revue *Vie Pédagogique*, revue éducationnelle québécoise publiée par *le Ministère de l'Éducation, du Loisir et du Sport* :

> Il est clairement demandé aux enseignants et enseignantes de sortir d'un modèle mécanique et séquentiel qui en a fait des techniciens applicateurs pour passer à une pratique professionnelle où ils auront une plus grande maîtrise des aspects fondamentaux de la vie scolaire que sont les contenus et les méthodes

> d'enseignement. Les nouveaux programmes s'adresseront à des professionnels qui auront le droit de choisir les moyens qu'ils jugeront les plus appropriés pour exercer leur métier efficacement (p. 6).

Pourtant l'étude de Vitale et Kaniuka (2009) démontre que les enseignants n'ont pas les connaissances nécessaires pour prendre des décisions concernant le choix du curriculum utilisé. Sans toutefois tenter de simplifier les mérites des enseignants, ne sont-ils pas justement des techniciens applicateurs ? Et puis, l'Enseignement Direct et la didactique de précision sont des pratiques exigeantes pour l'enseignant et pour les élèves, surtout si une approche ludique au matériel scolaire est favorisée comme lu à plusieurs reprises dans la revue *Vie Pédagogique* (Anctil, Collins, & Savard, 1991 ; Benoît, 1988 ; Carrier & Roy, 1999 ; Gagné & Coulombe, 1989 ; Renaud, 2006 ; Rioux, 2000 ; Rochette, 1994).

Les études ont clairement démontré la supériorité du modèle de l'enseignement direct avec et sans majuscules (Adams & Engelmann, 1996 ; Hempenstall, 2004 ; House et al., 1978 ; NRP, 2000 ; Rosenshine, 1979, 1986, 2009 ; Stebbins et al., 1977 ; Vitale & Kaniuka, 2009 ; Watkins, 1997). Il serait vital de s'interroger sur l'intérêt aux meilleures pratiques éducationnelles et aux données probantes en éducation dans les départements universitaires en éducation au Québec, comme au *Ministère de l'Éducation, des Loisirs et du Sport*.

APPENDICES

APPENDICE A

FEUILLE ÉCLAIR (AIL-EIL-EUIL [ail/ɛj/œj])

ail

eil

euil

APPENDICE B

FEUILLE D'EXERCICES (AIL-EIL-EUIL[ail/ɛj/œj])

euil / eil / ail

Nom: ______________________ Date: ______________

1	euil	ail	eil	ail	euil	ail	eil	euil	eil	euil	10
11	eil	euil	ail	eil	ail	euil	ail	eil	euil	eil	20
21	ail	euil	eil	ail	eil	euil	ail	eil	ail	euil	30
31	eil	ail	euil	ail	euil	eil	euil	ail	euil	eil	40
41	euil	eil	ail	eil	euil	eil	ail	euil	eil	ail	50
51	eil	ail	eil	euil	eil	ail	euil	ail	euil	ail	60
61	euil	eil	ail	euil	eil	ail	eil	euil	ail	euil	70
71	ail	euil	eil	ail	euil	eil	ail	eil	euil	eil	80
81	euil	eil	ail	eil	ail	euil	eil	ail	euil	ail	90
91	eil	ail	euil	ail	euil	eil	euil	ail	eil	ail	100

1	euil	eil	ail	euil	eil	ail	euil	eil	euil	ail	10
11	eil	euil	ail	eil	ail	euil	eil	euil	ail	eil	20
21	euil	ail	euil	eil	euil	ail	eil	ail	eil	euil	30
31	eil	ail	euil	eil	ail	eil	euil	eil	euil	ail	40
41	euil	ail	eil	ail	euil	eil	ail	euil	ail	eil	50
51	ail	eil	euil	eil	euil	ail	euil	ail	eil	ail	60
61	eil	euil	ail	euil	eil	ail	eil	euil	ail	eil	70
71	euil	ail	eil	euil	ail	eil	euil	ail	euil	eil	80
81	ail	eil	euil	eil	euil	ail	eil	ail	euil	ail	90
91	eil	euil	ail	eil	ail	euil	ail	eil	ail	euil	100

APPENDICE C

FEUILLE DE MARQUES

Didactique de Précision :
Résultats

Nom : Groupe :

Date : Lettres & Phonèmes en français

APPENDICE D

SCÉNARIO D'INTRODUCTION À L'UTILISATION DU SACC

SACC introduction's script for all four groups

Before introducing the chart:

1. Students sit in semi-circle in the classroom (previous desk arrangement);
2. Students are placed according to their level of performance in class (according to the school policy);
3. There is a pre-written scripted lesson to follow while introducing the SACC;
4. While students charted almost every day of the week, both teacher and researcher were present in the classroom to allow more time for immediate corrections;
5. We practiced charting on the day of the introduction of the SACC with immediate corrections;
6. Students' charts were supervised on an everyday basis by the researcher.

Presentation:

Presentation of materials:

- A representation of the SACC and the score sheet are drawn on the chalkboard;
- Students' charts are placed in front of them in a folder;

Presenting the tasks:

- Since the age of students is ranging from 12 to 14, and that they already know how to use the SACC in their other classrooms, the presentation, practice and correction took about 40 minutes. According to Maloney (1998), the presentation with 'older' students can be accomplished in 15 to 30 minutes.

Script: Model – lead – test

1. Put on students' desks their folder containing their two charts.
2. Say: **"When you do the 30 second timings in the classroom, you write your score on the score sheet. Now, you will also chart your score on the appropriate chart".**
3. Take the first chart (PS1), put your finger on PS1 at the bottom of the chart, and show it to all students.
4. Say: **"Take your 'PS1' chart in your folder, and place it on your desk, in front of you"**.
5. Reinforce the students that do it right away.
6. Say: **"Look at the board, you can see a chart that looks like the one you have on your desk. I will show you how to chart with this model"**.
7. Say: **"On my score sheet, let's pretend I have a score of 50 'correct' and 5 'errors'"**.
8. Write the scores on the score sheet on the board.
9. Say: **"30 seconds times 2 equal 60 seconds. 60 seconds equals one minute. The chart only uses 1 minute timings. Since we work with 30 second timings, I have to double my scores on my score sheet to chart them on the corresponding lines. Thus our charting rule is: double and chart"**.
10. Repeat: "**Our charting rule is: double and chart. Get ready**". Signal.
11. Say: **"That's right. Our charting rule is: double and chart"**.

12. Say: **"The 'correct' symbol is a dot. The 'error' symbol is an 'X'"**.
13. Write the symbols on the score sheet besides 'correct' and 'error'.
14. Say: **"The correct symbol is?"** Pause. Signal.
15. Say: **"So if my score is 50 'correct' on a 30 second timing, and our charting rule is: double and chart, I will double my score and then chart. 50 times 2 equal 100. I will put a dot on the 100 line"**.
16. Put the dot on the 100 line while saying: **"I put a dot on the 100 line"**.
17. Say: **"So if my score is 5 'errors', and our charting rule is: double and chart, I will double my score and than chart. 5 times 2 equal 10. I will put an 'X' on the 10 line"**.
18. Put the 'X' on the 10 line while saying: **"I put an 'X' on the 10 line"**.
19. Say: **"Now, your turn. Our charting rule is: double and chart. Let's pretend your score is 50 'correct' and 5 'errors'. Chart the scores on the corresponding lines. Get ready"**. Signal.
20. Reinforce the students who do it right away. Correct the mistakes, if any.
21. If students don't get it right away, model again with another example that falls on a line.
22. Scores that fall between lines: Say: **"When I have a score that falls between lines, I approximate the distance between two lines. Our charting rule becomes: double, approximate, and chart"**.
23. Repeat: **"Our charting rule becomes: double, approximate, and chart. Get ready"**. Signal.
24. Say: **"That's right. Our charting rule becomes: double, approximate, and chart"**.
25. Use an example that falls between the lines. Say: **"Let's pretend I have a score that falls between the lines. Let's pretend I have a score of 39 'correct' and 13 'errors'"**.
26. Write the scores on the score sheet on the board.
27. Say: **"So if I have a score of 39 'correct', and our charting rule is: double approximate, and chart, I will double my score, approximate the distance between two lines, and chart. 39 times 2 equal 78. 78 go between the 75 and 80 lines. I will put a dot between lines"**.
28. Put the dot between the lines while saying: **"I put a dot approximately between the lines 75 and 80"**.
29. Say: **"So if I have a score of 13 'errors', I will double my score, approximate the distance between two lines, and chart. 13 times 2 equal 26. 26 go approximately between the 25 and 30 lines"**.
30. Put the 'X' between the lines 25 and 30 while saying: **"I put an 'X' approximately between the 25 and 30 lines"**.
31. Say: **"Now, your turn. Our charting rule is: double, approximate, and chart. Let's pretend you have a score of 53 'correct' and 16 'errors'. Get ready"**. Signal.
32. Reinforce the students who do it right away.
33. Correct the students immediately.
34. Do another example if the students make mistakes.
35. Do 'timings' and make students chart their own scores.

36. Verify the students' charting of their 'correct' and 'error', and fix the problems if needed.
37. Do 'timings' with the second practice chart (PS2), and make the students chart their own scores on their SACC.

APPENDICE E

FORMULAIRE DE CONSENTEMENT DES ÉLÈVES

Important Announcement

Dear parents:

We are glad to announce that Madame Anick Legault, a doctoral student in Psychology at Université du Québec à Montréal, will be conducting a research project that will involve the seventh- and eighth-grade students of French. Madame Dominique St-Pierre will use efficient teaching methods such as Precision Teaching and SAFMEDS to improve retention of the material taught in class.

Please read the following information carefully:

- While conducting this research, all personal information gathered will be confidential and will not be shared with anyone under any circumstances;

- As part of Madame Legault's doctoral thesis, the final results will be publicized only through scientific articles and communications. These publications will contain no names and will respect anonymity of each participant;

- Your child's grade will be based on classroom-related work and activities given by the French teacher, and not on the research activities;

- You may withdraw your child from this research project at any time, without prejudice;

- You can obtain more information concerning this research project by contacting Madame Legault, Monday through Thursday, 9:00 a.m. to 3:00 p.m., at the following number: (303) 734-1995, extension 227.

We thank you for your cooperation!

I give permission for my child to participate in the research project in French class (mentioned on the previous page).

Child's first name: ______________________

Child's last name: ______________________

Parent's first name: ______________________

Parent's last name: ______________________

Signature: ______________________ Date: ____________

If you do not permit your child to participate in the research project, he/she will continue to receive the same educational benefits and services that the other students participating in the research will receive, although no data will be accumulated from your child's work.

____

Anick Legault
Researcher

____

Dominique St-Pierre
French teacher

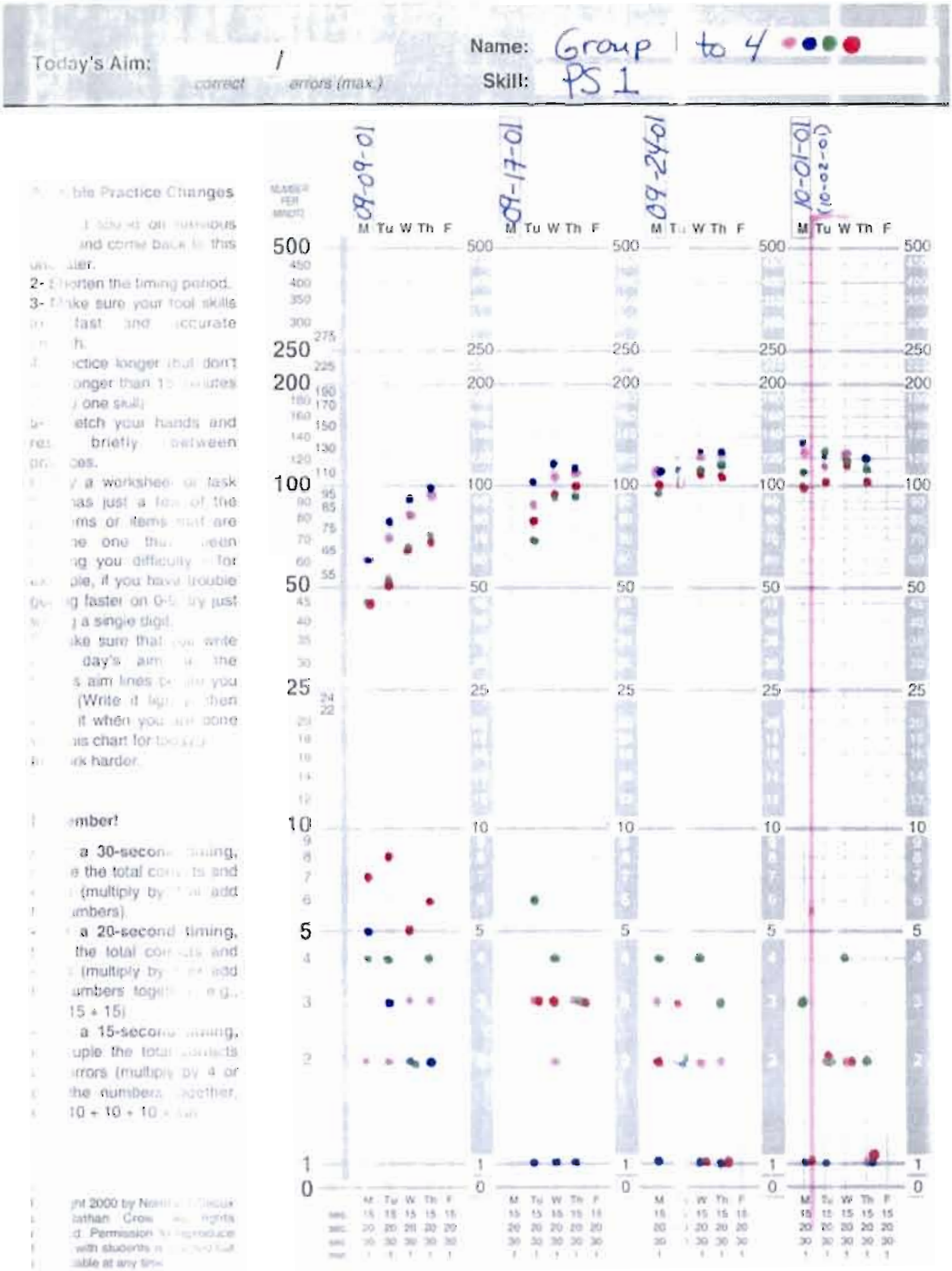
____

Nathan Crow
Principal

APPENDICE F

SACC DES QUATRE CLASSES DU DEVIS À NIVEAUX DE BASE MULTIPLES POUR

LA PS1



Today's Aim: / correct errors (max.)
Name: Group 1 to 4
Skill: PS 1
09-09-01
09-17-01
09-24-01
10-01-01
(10-02-01)
M Tu W Th F
500
250
200
100
50
25
10
5
1
0

Today's Aim: _____ / _____
correct errors (max.)

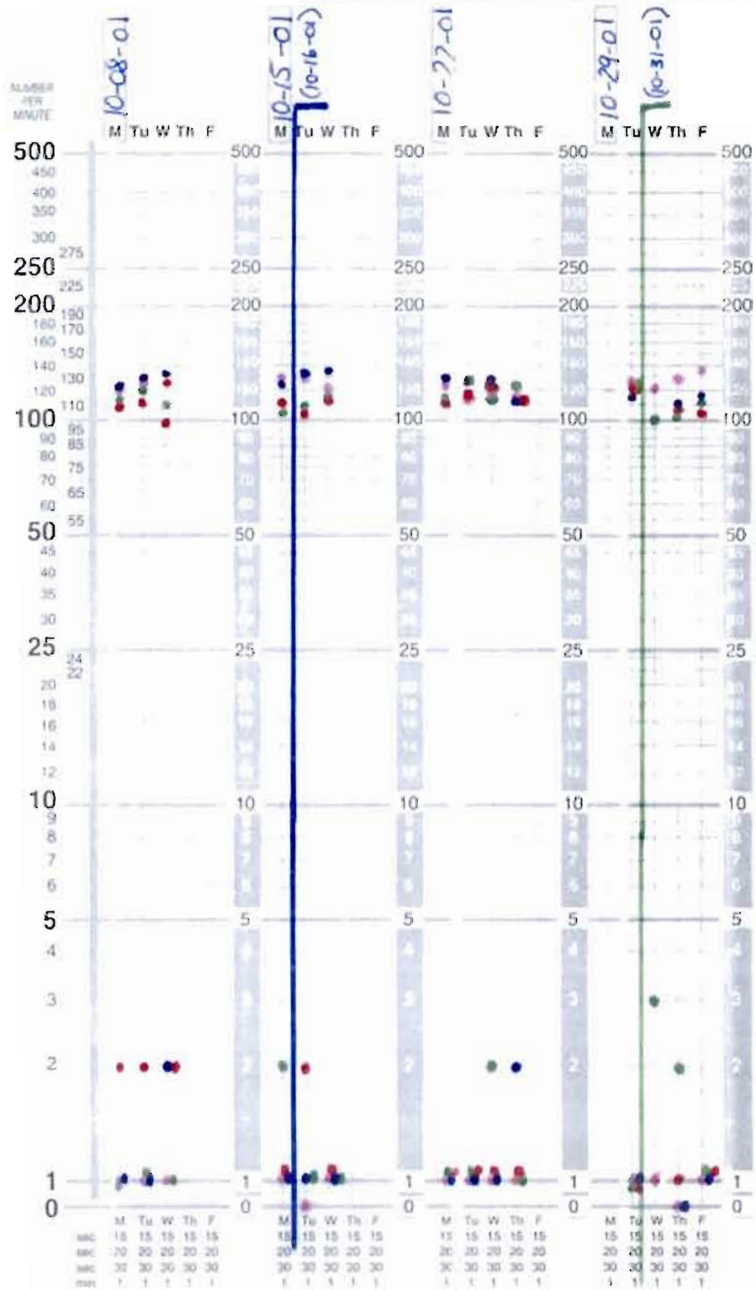
Name: Group 1 to 4
Skill: PS 1

Possible Practice Changes

1- Build speed on previous slices and come back to this one later.
2- Shorten the timing period
3- Make sure your tool skills are fast and accurate enough
4- Practice longer (but don't work longer than 15 minutes on any one skill)
5- Stretch your hands and rest briefly between practices.
6- Try a worksheet or task that has just a few of the problems or items that are on the one that's been causing you difficulty - for example, if you have trouble getting faster on 0-9, try just writing a single digit
7- Make sure that you write each day's aim on the today's aim lines before you start! (Write it lightly, then erase it when you are done with this chart for today.)
8- Work harder

Remember!

- For a 30-second timing, double the total corrects and errors (multiply by 2 or add the numbers)
- For a 20-second timing, triple the total corrects and errors (multiply by 3 or add the numbers together, e.g., 15 + 15 + 15)
- For a 15-second timing, quadruple the total corrects and errors (multiply by 4 or add the numbers together, e.g., 10 + 10 + 10 + 10)



Today's Aim: _____ / _____
correct errors (max.)

Name: Group 1 to 4

Skill: PS 1

Possible Practice Changes

1- Build speed on previous slices and come back to this one later.

2- Shorten the timing period.

3- Make sure your tool skills are fast and accurate enough.

4- Practice longer (but don't work longer than 15 minutes on any one skill).

5- Stretch your hands and rest briefly between practices.

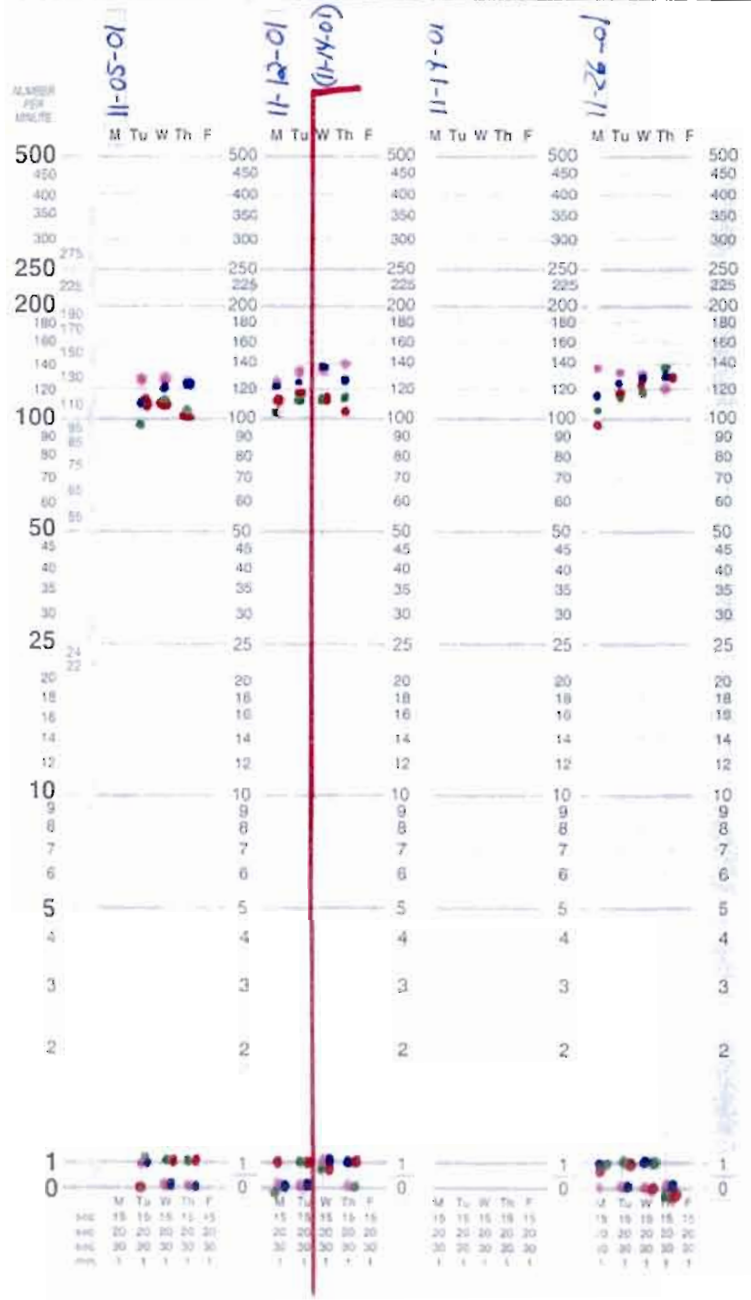
6- Try a worksheet or task that has just a few of the problems or items that are on the one that's been causing you difficulty - for example, if you have trouble getting faster on 0-9, try just writing a single digit.

7- Make sure that you write each day's aim on the today's aim lines before you start! (Write it lightly, then erase it when you are done with this chart for today.)

8- Work harder.

Remember!

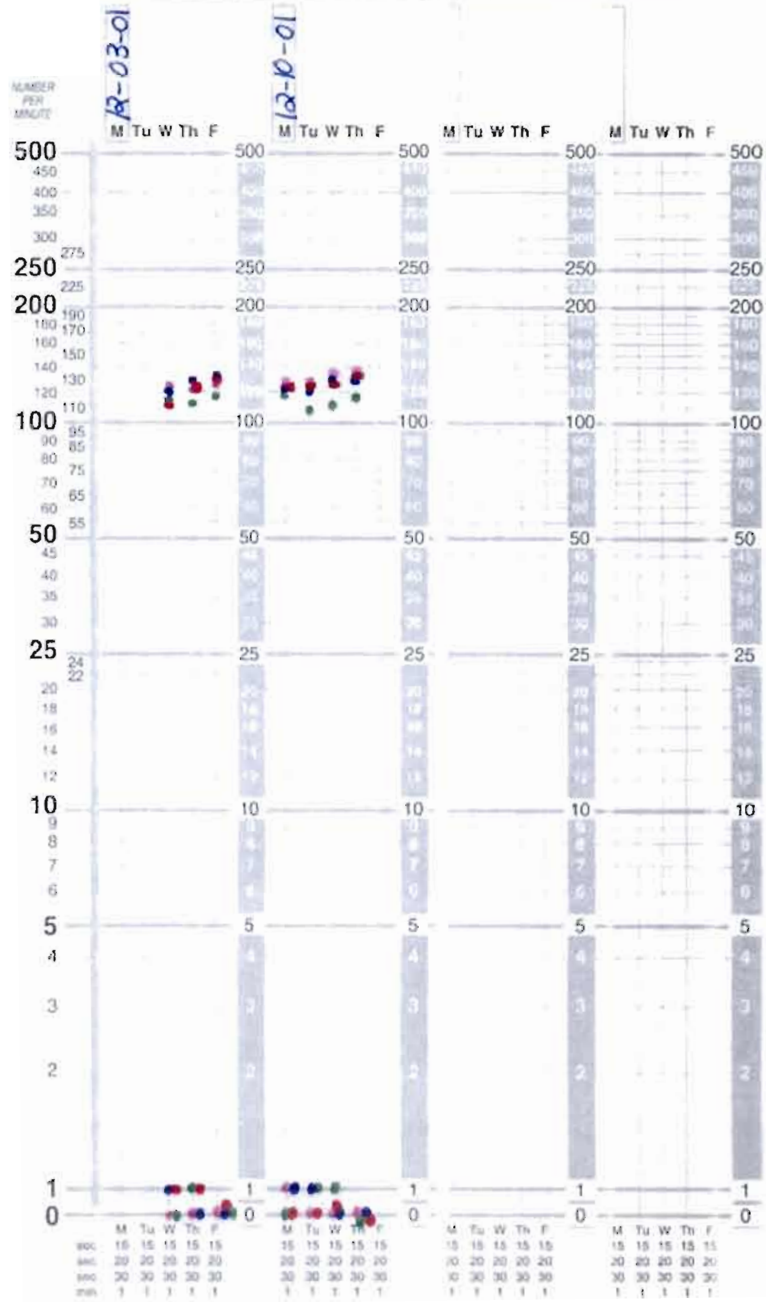
- **For a 30-second timing,** double the total corrects and errors (multiply by 2 or add the numbers).
- **For a 20-second timing,** triple the total corrects and errors (multiply by 3 or add the numbers together, e.g., 15 + 15 + 15).
- **For a 15-second timing,** quadruple the total corrects and errors (multiply by 4 or add the numbers together, e.g., 10 + 10 + 10 + 10).



Today's Aim: /
correct errors (max.)

Name: Group 1 to 4

Skill: PS1



Possible Practice Changes

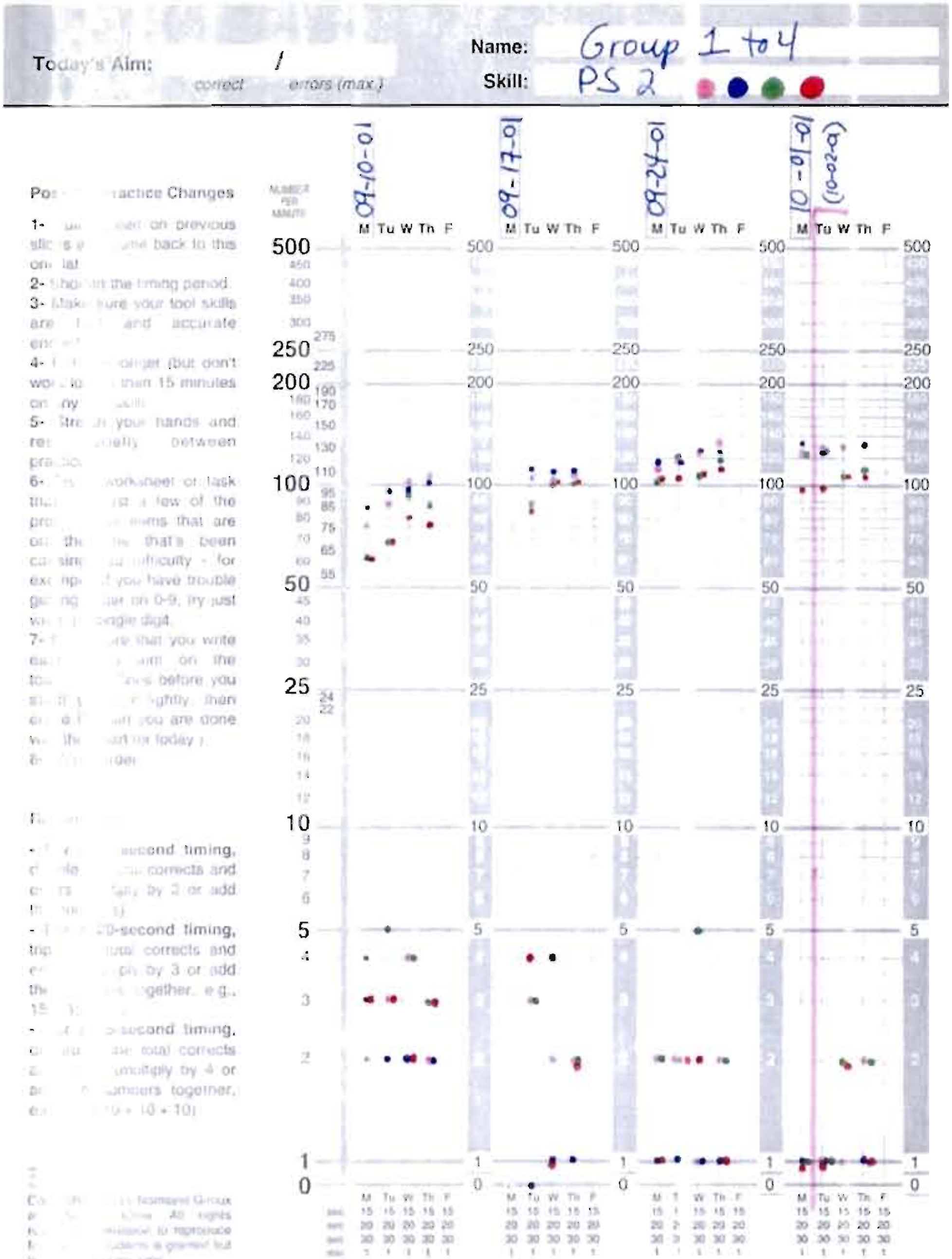
1- Build speed on previous slices and come back to this one later.
2- Shorten the timing period.
3- Make sure your tool skills are fast and accurate enough.
4- Practice longer (but don't work longer than 15 minutes on any one skill).
5- Stretch your hands and rest briefly between practices.
6- Try a worksheet or task that has just a few of the problems or items that are on the one that's been causing you difficulty - for example, if you have trouble getting faster on 0-9, try just writing a single digit.
7- Make sure that you write each day's aim on the today's aim lines before you start! (Write it lightly, then erase it when you are done with this chart for today.)
8- Work harder.

Remember!

- **For a 30-second timing,** double the total corrects and errors (multiply by 2 or add the numbers).
- **For a 20-second timing,** triple the total corrects and errors (multiply by 3 or add the numbers together, e.g., 15 + 15 + 15).
- **For a 15-second timing,** quadruple the total corrects and errors (multiply by 4 or add the numbers together, e.g., 10 + 10 + 10 + 10).

APPENDICE G

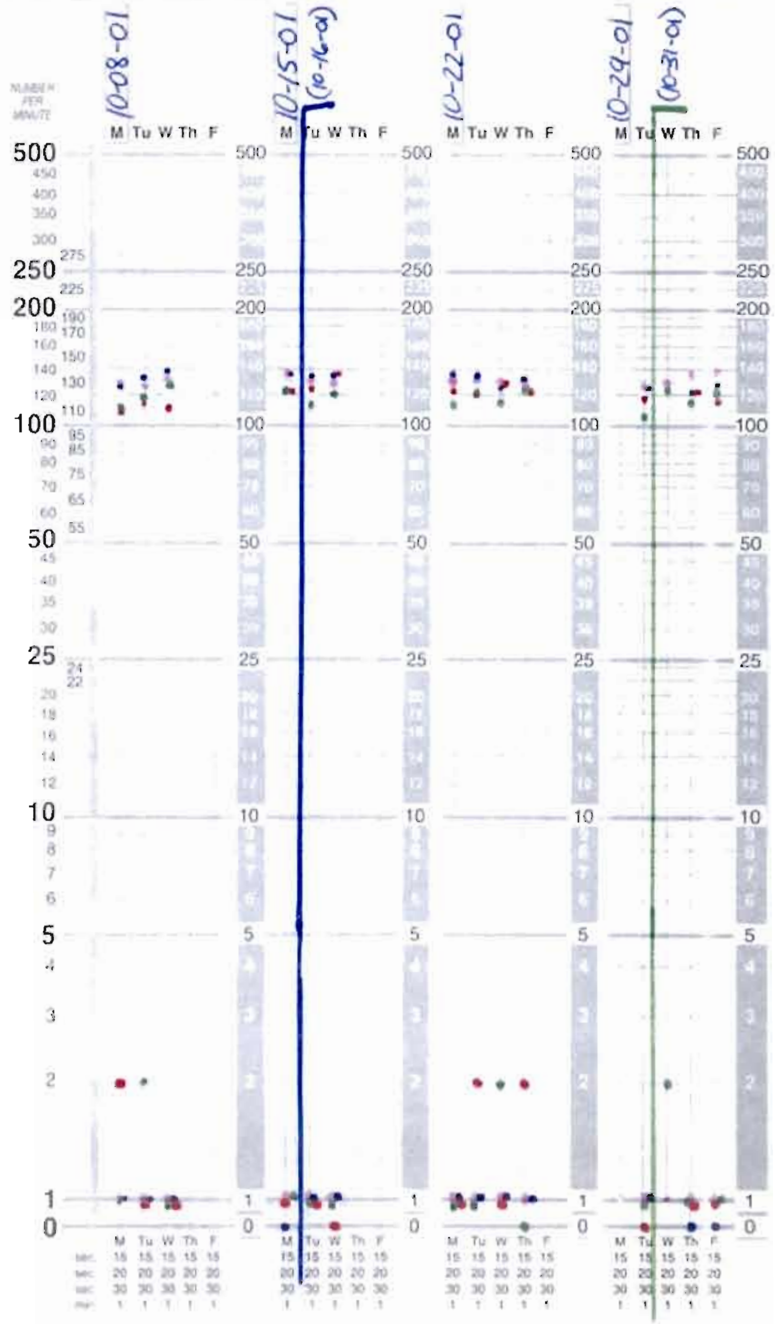
SACC DES QUATRE CLASSES DU DEVIS À NIVEAUX DE BASE MULTIPLES POUR LA PS2


Today's Aim:
correct
errors (max.)
Name: Group 1 to 4
Skill: PS 2
09-10-01
09-17-01
09-24-01
10-01-01
(10-02-01)
M Tu W Th F
500
250
200
100
50
25
10
5
1
0

Today's Aim: /
correct errors (max.)

Name: Group 1 to 4

Skill: PS 2

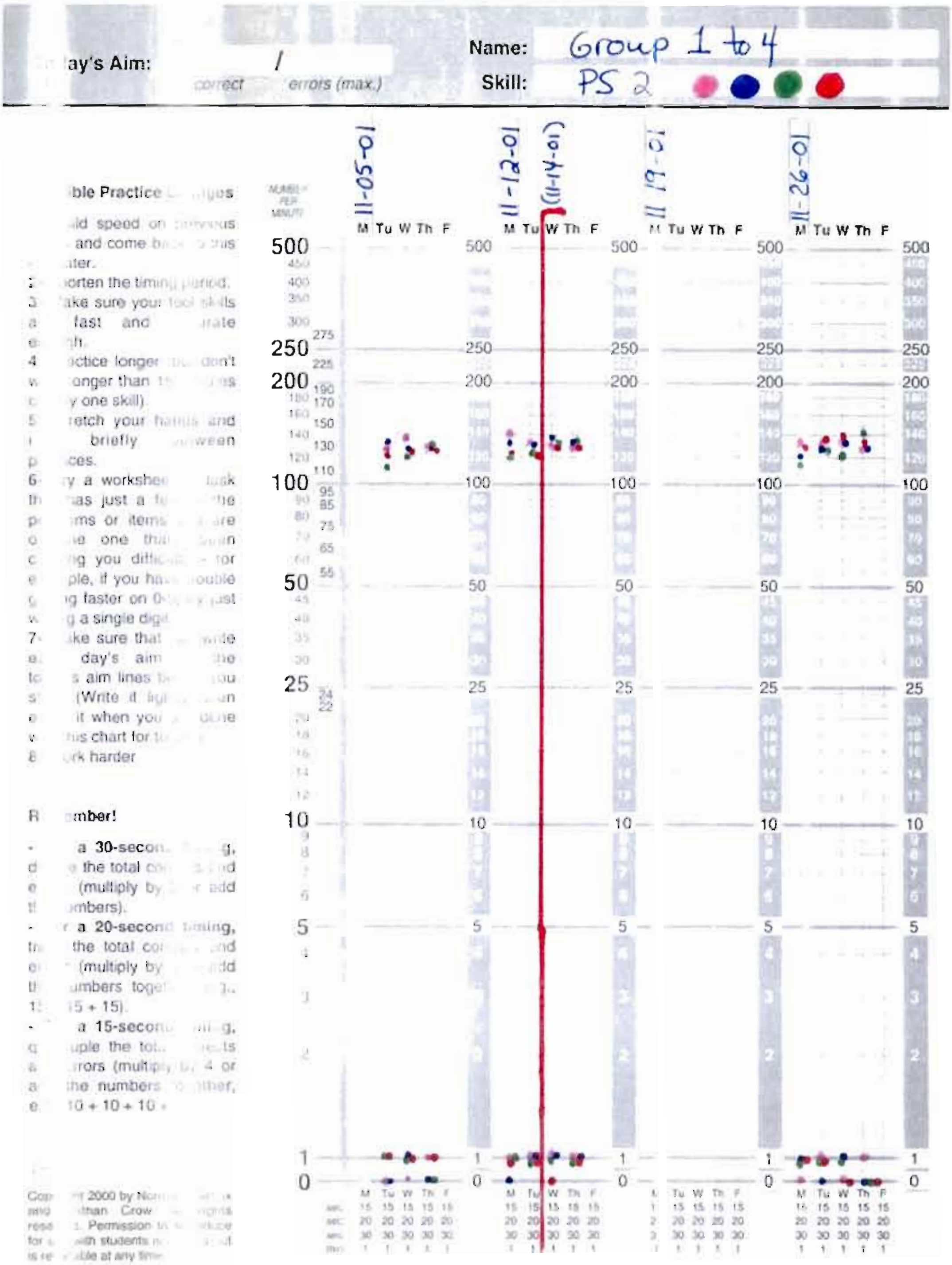


Possible Practice Changes

1- Build speed on previous slices and come back to this one later.
2- Shorten the timing period.
3- Make sure your tool skills are fast and accurate enough.
4- Practice longer (but don't work longer than 15 minutes on any one skill).
5- Stretch your hands and rest briefly between practices.
6- Try a worksheet or task that has just a few of the problems or items that are on the one that's been causing you difficulty - for example, if you have trouble getting faster on 0-9, try just writing a single digit.
7- Make sure that you write each day's aim on the today's aim lines before you start! (Write it lightly, then erase it when you are done with this chart for today.)
8- Work harder.

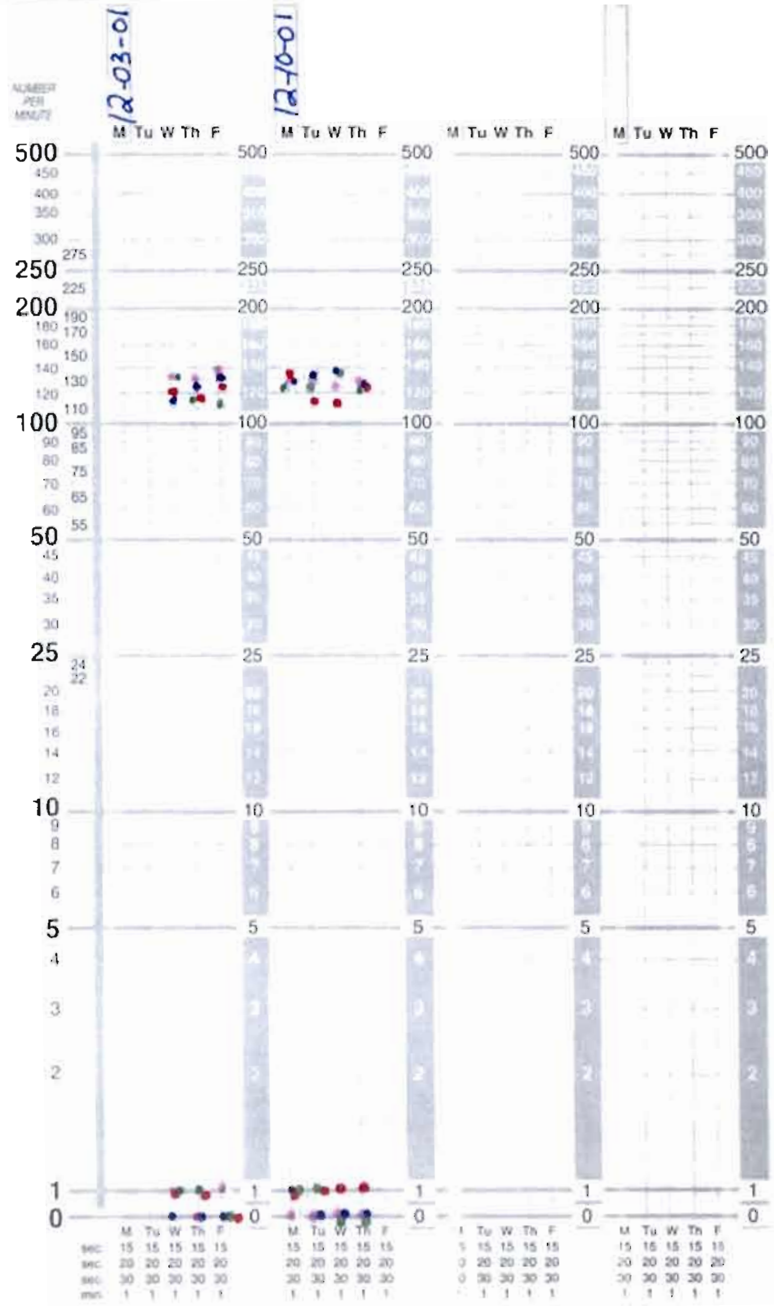
Remember!

- For a 30-second timing, double the total corrects and errors (multiply by 2 or add the numbers).
- For a 20-second timing, triple the total corrects and errors (multiply by 3 or add the numbers together, e.g., 15 + 15 + 15).
- For a 15-second timing, quadruple the total corrects and errors (multiply by 4 or add the numbers together, e.g., 10 + 10 + 10 + 10).


ay's Aim:
correct
errors (max.)
Name: Group 1 to 4
Skill: PS 2
11-05-01
11-12-01
(11-14-01)
11-19-01
11-26-01
M Tu W Th F
500
250
200
100
50
25
10
5
1
0
ble Practice
mber!

Today's Aim: /
correct errors (max.)

Name: Group 1 to 4
Skill: PS o



Possible Practice Changes

1- Build speed on previous slices and come back to this one later.
2- Shorten the timing period.
3- Make sure your tool skills are fast and accurate enough.
4- Practice longer (but don't work longer than 15 minutes on any one skill).
5- Stretch your hands and rest briefly between practices.
6- Try a worksheet or task that has just a few of the problems or items that are on the one that's been causing you difficulty - for example, if you have trouble getting faster on 0-9, try just writing a single digit.
7- Make sure that you write each day's aim on the today's aim lines before you start! (Write it lightly, then erase it when you are done with this chart for today.)
8- Work harder

Remember!

- For a 30-second timing, double the total corrects and errors (multiply by 2 or add the numbers).
- For a 20-second timing, triple the total corrects and errors (multiply by 3 or add the numbers together, e.g., 15 + 15 + 15).
- For a 15-second timing, quadruple the total corrects and errors (multiply by 4 or add the numbers together, e.g., 10 + 10 + 10 + 10).

APPENDICE H

SACC DES ÉLÈVES QUI PRÉSENTENT UN RENDEMENT SCOLAIRE FAIBLE ET DE CEUX QUI PRÉSENTENT UN RENDEMENT PLUS ÉLEVÉ POUR LA PS1

Today's Aim: _____ / _____
correct errors (max)

Name: High Vs. Low

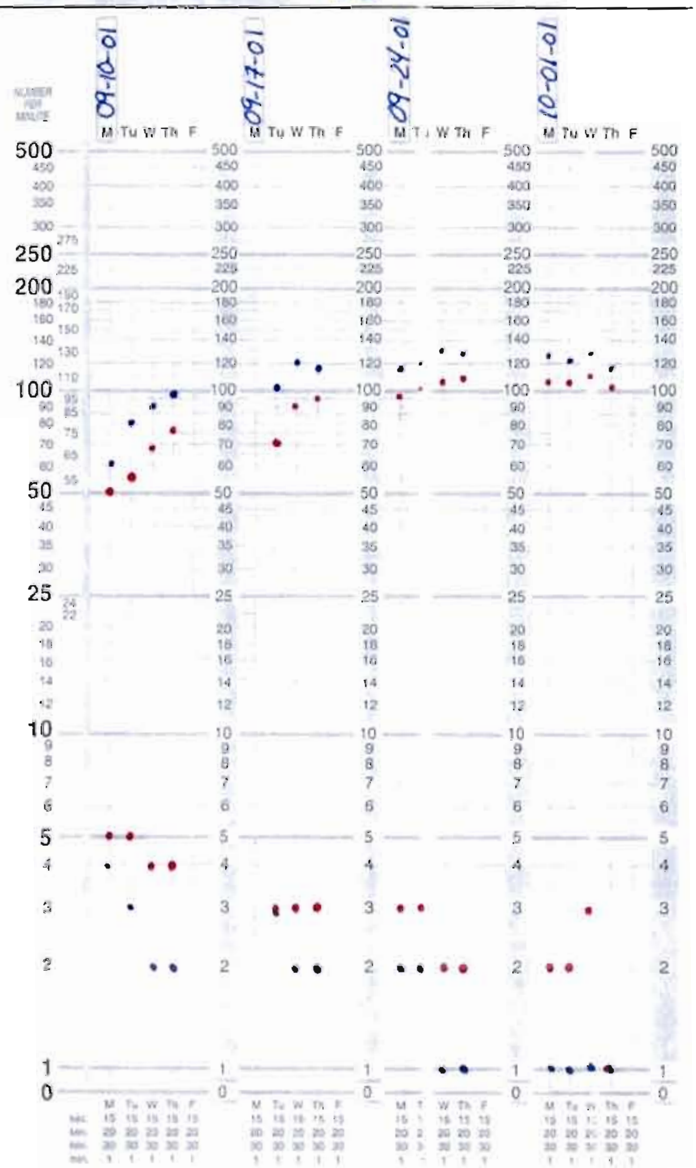
Skill: PS 1

Possible Practice Changes

1- Build speed on previous slices and come back to this one later.
2- Shorten the timing period.
3- Make sure your tool skills are fast and accurate enough.
4- Practice longer (but don't work longer than 15 minutes on any one skill).
5- Stretch your hands and rest briefly between practices.
6- Try a worksheet or task that has just a few of the problems or items that are on the one that's been causing you difficulty - for example, if you have trouble getting faster on 0-9, try just writing a single digit.
7- Make sure that you write each day's aim on the today's aim lines before you start! (Write it lightly, then erase it when you are done with this chart for today.)
8- Work harder.

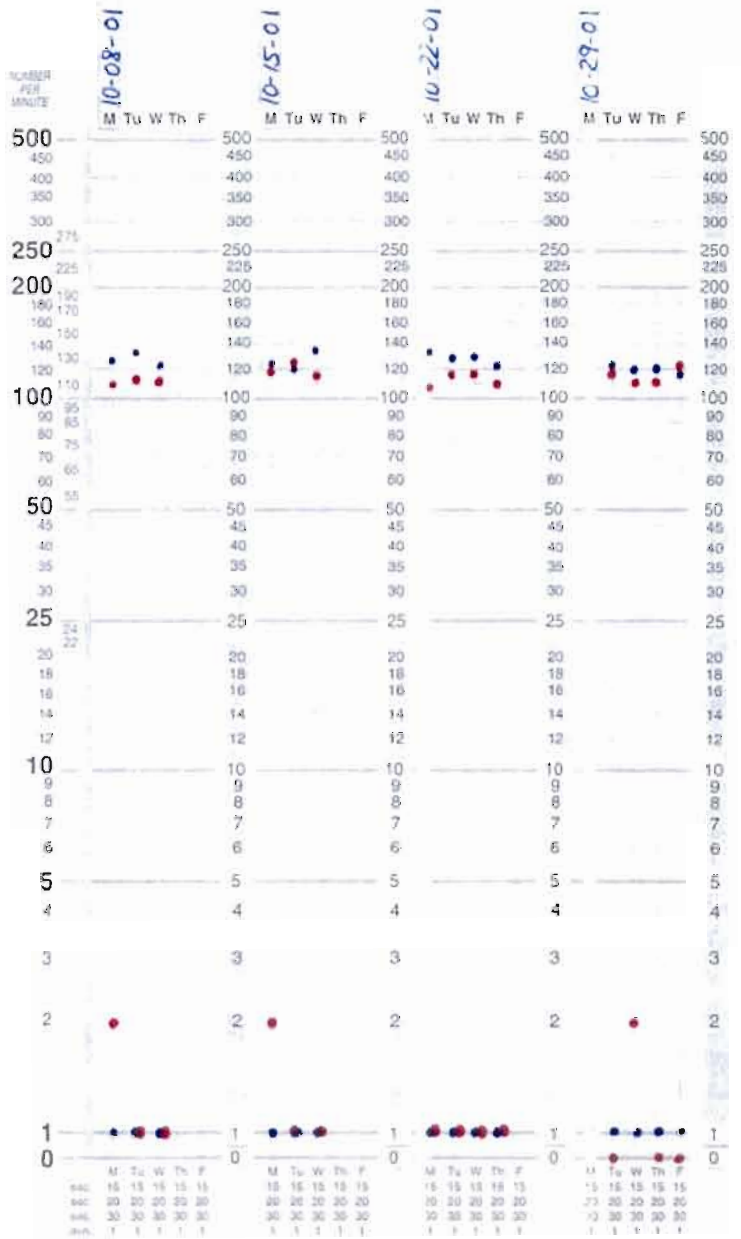
Remember!

- **For a 30-second timing,** double the total corrects and errors (multiply by 2 or add the numbers).
- **For a 20-second timing,** triple the total corrects and errors (multiply by 3 or add the numbers together, e.g., 15 + 15 + 15).
- **For a 15-second timing,** quadruple the total corrects and errors (multiply by 4 or add the numbers together, e.g., 10 + 10 + 10 + 10)



Today's Aim: _____ / _____
correct errors (max.)

Name: High vs. Low
Skill: PS 1



Possible Practice Changes

1- Build speed on previous slices and come back to this one later.
2- Shorten the timing period.
3- Make sure your tool skills are fast and accurate enough.
4- Practice longer (but don't work longer than 15 minutes on any one skill).
5- Stretch your hands and rest briefly between practices.
6- Try a worksheet or task that has just a few of the problems or items that are on the one that's been causing you difficulty - for example, if you have trouble getting faster on 0-9, try just writing a single digit.
7- Make sure that you write each day's aim on the today's aim lines before you start! (Write it lightly, then erase it when you are done with this chart for today.)
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Remember!

- **For a 30-second timing,** double the total corrects and errors (multiply by 2 or add the numbers)
- **For a 20-second timing,** triple the total corrects and errors (multiply by 3 or add the numbers together, e.g., 15 + 15 + 15)
- **For a 15-second timing,** quadruple the total corrects and errors (multiply by 4 or add the numbers together, e.g., 10 + 10 + 10 + 10)

Today's Aim: correct / errors (max.)

Name: high Vs. low

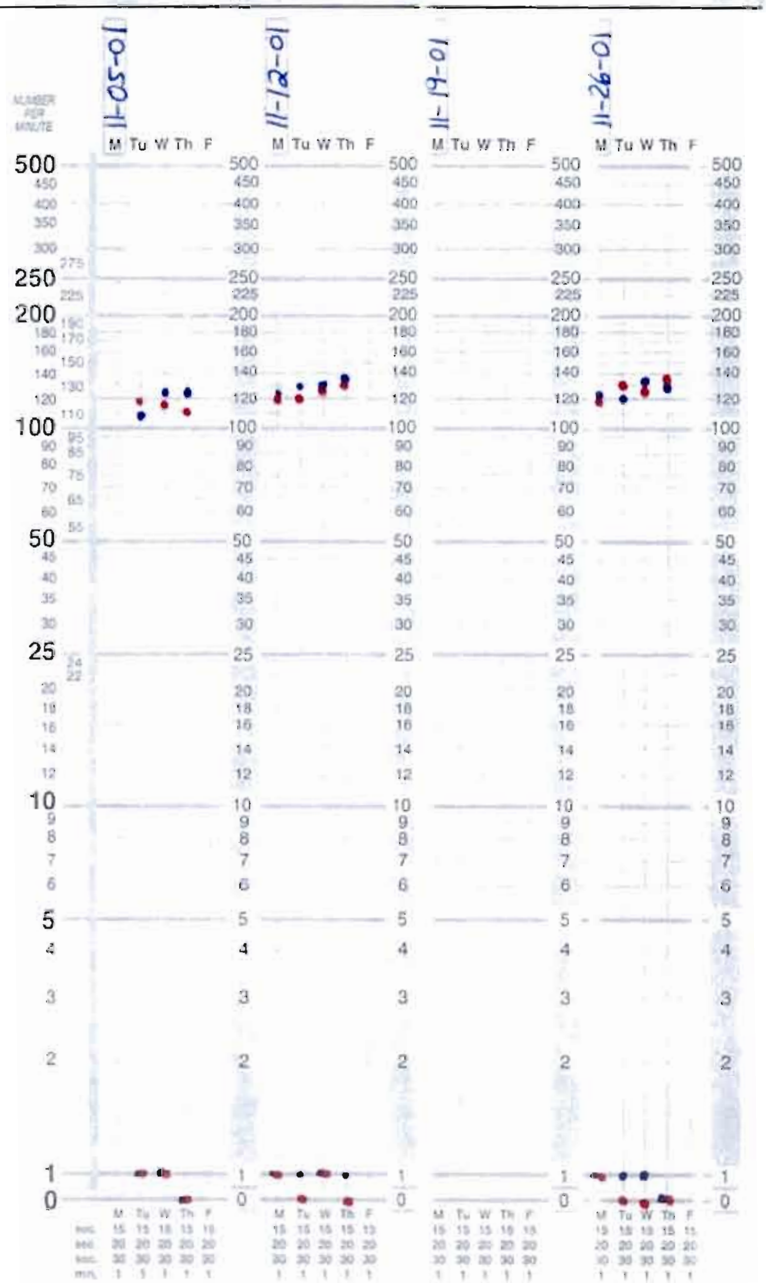
Skill: PS 1

Possible Practice Changes

1- Build speed on previous slices and come back to this one later.
2- Shorten the timing period.
3- Make sure your tool skills are fast and accurate enough.
4- Practice longer (but don't work longer than 15 minutes on any one skill).
5- Stretch your hands and rest briefly between practices.
6- Try a worksheet or task that has just a few of the problems or items that are on the one that's been causing you difficulty - for example, if you have trouble getting faster on 0-9, try just writing a single digit.
7- Make sure that you write each day's aim on the today's aim lines before you start! (Write it lightly, then erase it when you are done with this chart for today.)
8- Work harder.

Remember!

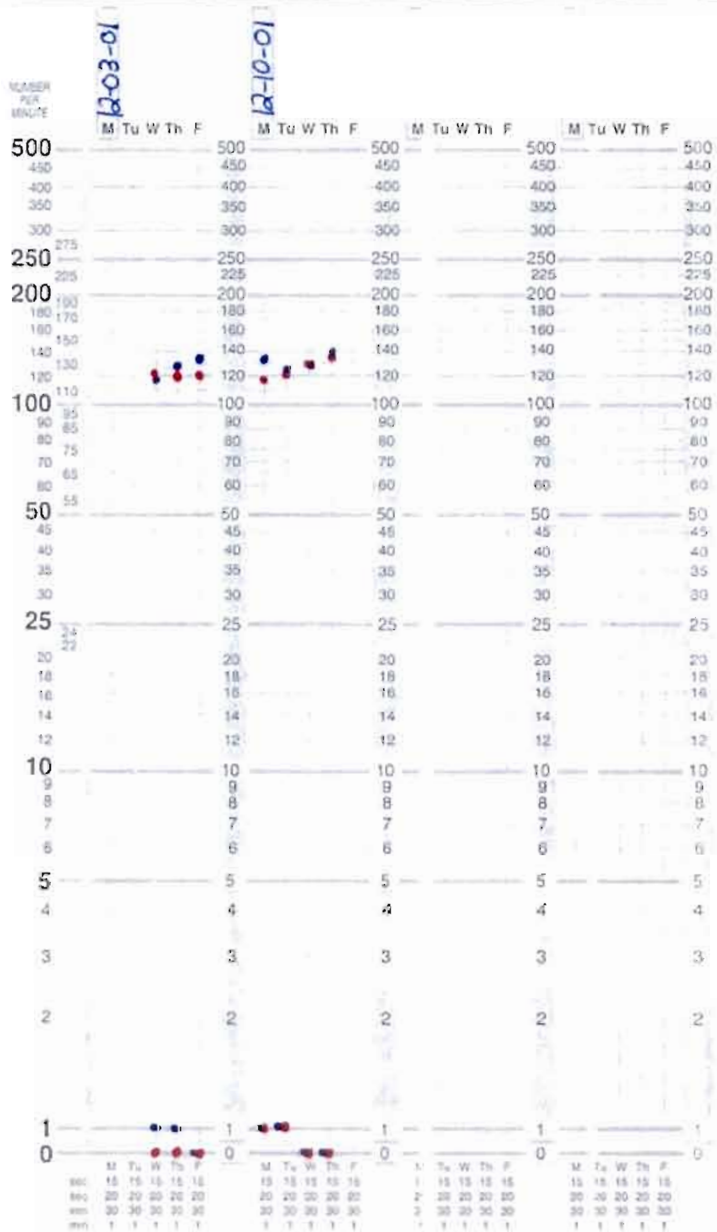
- **For a 30-second timing,** double the total corrects and errors (multiply by 2 or add the numbers).
- **For a 20-second timing,** triple the total corrects and errors (multiply by 3 or add the numbers together, e.g., 15 + 15 + 15).
- **For a 15-second timing,** quadruple the total corrects and errors (multiply by 4 or add the numbers together, e.g., 10 + 10 + 10 + 10).



Today's Aim: ______ / ______
correct errors (max.)

Name: High vs. Low

Skill: PS 1



Possible Practice Changes

1- Build speed on previous slices and come back to this one later.
2- Shorten the timing period.
3- Make sure your tool skills are fast and accurate enough.
4- Practice longer (but don't work longer than 15 minutes on any one skill).
5- Stretch your hands and rest briefly between practices.
6- Try a worksheet or task that has just a few of the problems or items that are on the one that's been causing you difficulty - for example, if you have trouble getting faster on 0-9, try just writing a single digit.
7- Make sure that you write each day's aim on the today's aim lines before you start! (Write it lightly, then erase it when you are done with this chart for today.)
8- Work harder.

Remember!

- **For a 30-second timing,** double the total corrects and errors (multiply by 2 or add the numbers).
- **For a 20-second timing,** triple the total corrects and errors (multiply by 3 or add the numbers together, e.g., 15 + 15 + 15).
- **For a 15-second timing,** quadruple the total corrects and errors (multiply by 4 or add the numbers together, e.g., 10 + 10 + 10 + 10).

APPENDICE I

SACC DES ÉLÈVES QUI PRÉSENTENT UN RENDEMENT SCOLAIRE FAIBLE ET DE CEUX QUI PRÉSENTENT UN RENDEMENT PLUS ÉLEVÉ POUR LA PS2

Today's Aim: correct / errors (max.)

Name: High Vs. Low

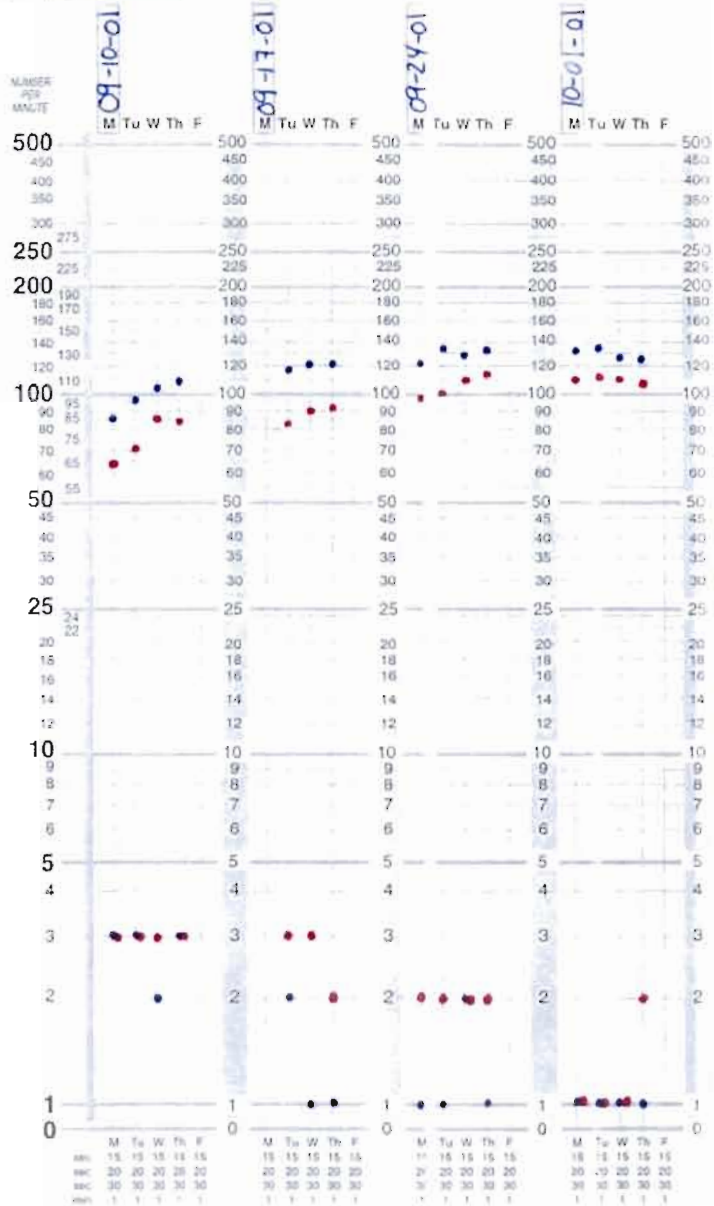
Skill: PS 2

Possible Practice Changes

1- Build speed on previous slices and come back to this one later.
2- Shorten the timing period.
3- Make sure your tool skills are fast and accurate enough.
4- Practice longer (but don't work longer than 15 minutes on any one skill).
5- Stretch your hands and rest briefly between practices.
6- Try a worksheet or task that has just a few of the problems or items that are on the one that's been causing you difficulty - for example, if you have trouble getting faster on 0-9, try just writing a single digit.
7- Make sure that you write each day's aim on the today's aim lines before you start! (Write it lightly, then erase it when you are done with this chart for today.)
8- Work harder.

Remember!

- **For a 30-second timing,** double the total corrects and errors (multiply by 2 or add the numbers).
- **For a 20-second timing,** triple the total corrects and errors (multiply by 3 or add the numbers together, e.g., 15 + 15 + 15).
- **For a 15-second timing,** quadruple the total corrects and errors (multiply by 4 or add the numbers together, e.g., 10 + 10 + 10 + 10).



Today's Aim: correct / errors (max.)

Name: High Vs. Low

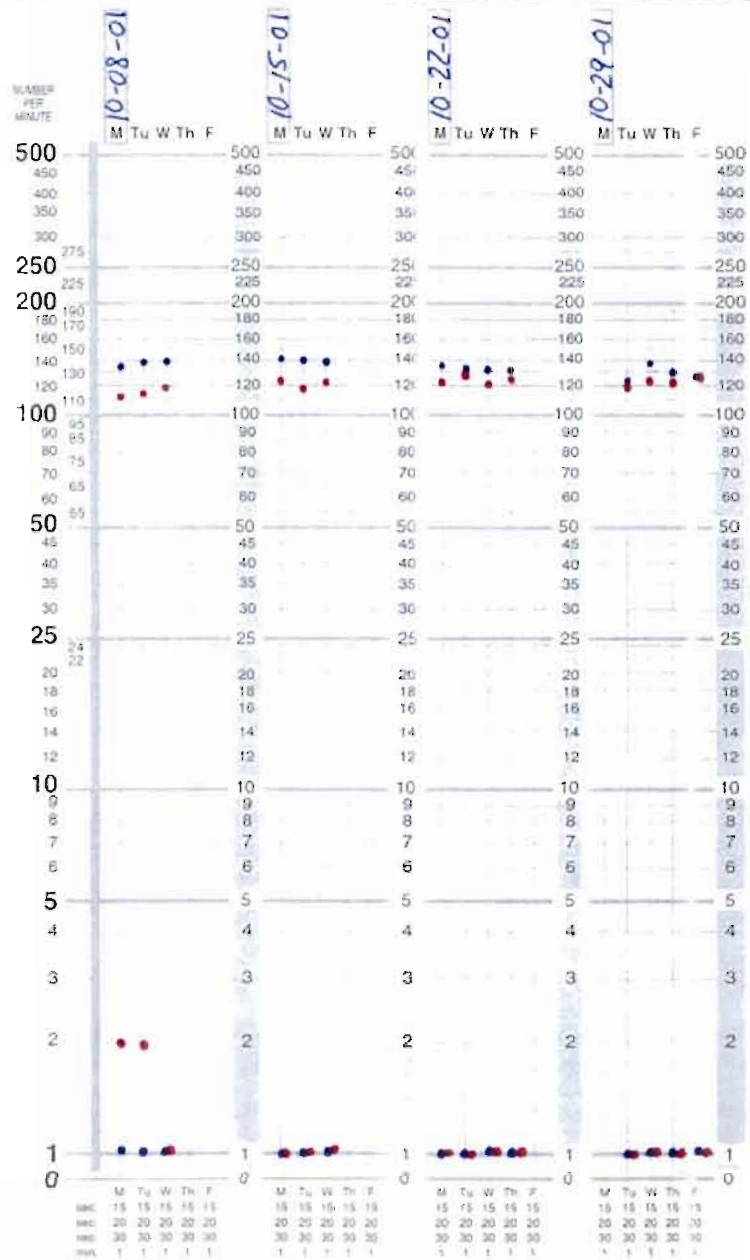
Skill: PS 3

Possible Practice Changes

1- Build speed on previous slices and come back to this one later.
2- Shorten the timing period.
3- Make sure your tool skills are fast and accurate enough.
4- Practice longer (but don't work longer than 15 minutes on any one skill).
5- Stretch your hands and rest briefly between practices.
6- Try a worksheet or task that has just a few of the problems or items that are on the one that's been causing you difficulty - for example, if you have trouble getting faster on 0-9, try just writing a single digit.
7- Make sure that you write each day's aim on the today's aim lines before you start! (Write it lightly, then erase it when you are done with this chart for today.)
8- Work harder

Remember!

- **For a 30-second timing,** double the total corrects and errors (multiply by 2 or add the numbers)
- **For a 20-second timing,** triple the total corrects and errors (multiply by 3 or add the numbers together, e.g., 15 + 15 + 15)
- **For a 15-second timing,** quadruple the total corrects and errors (multiply by 4 or add the numbers together, e.g., 10 + 10 + 10 + 10).



Today's Aim: correct / errors (max.)

Name: High Vs. low

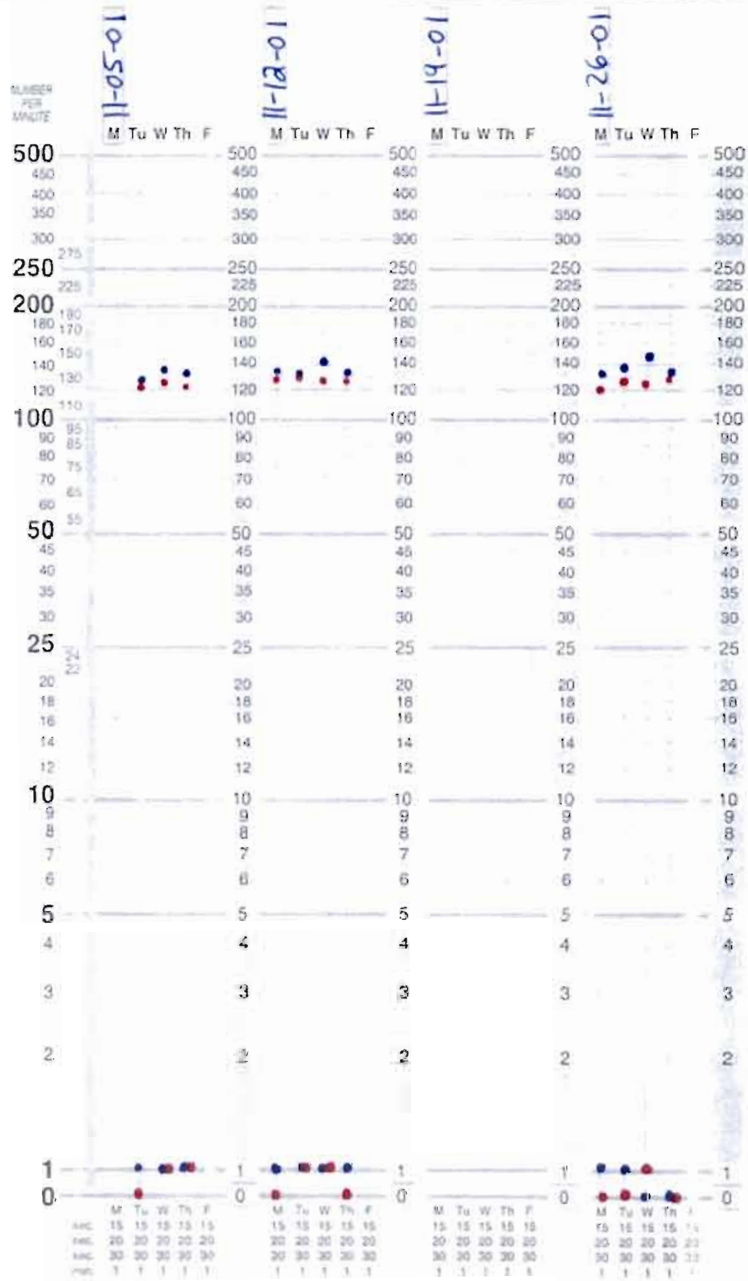
Skill: PS 2

Possible Practice Changes

1- Build speed on previous slices and come back to this one later.
2- Shorten the timing period.
3- Make sure your tool skills are fast and accurate enough.
4- Practice longer (but don't work longer than 15 minutes on any one skill).
5- Stretch your hands and rest briefly between practices.
6- Try a worksheet or task that has just a few of the problems or items that are on the one that's been causing you difficulty - for example, if you have trouble getting faster on 0-9, try just writing a single digit.
7- Make sure that you write each day's aim on the today's aim lines before you start! (Write it lightly, then erase it when you are done with this chart for today.)
8- Work harder

Remember!

- **For a 30-second timing,** double the total corrects and errors (multiply by 2 or add the numbers).
- **For a 20-second timing,** triple the total corrects and errors (multiply by 3 or add the numbers together, e.g., 15 + 15 + 15)
- **For a 15-second timing,** quadruple the total corrects and errors (multiply by 4 or add the numbers together, e.g., 10 + 10 + 10 + 10)



Today's Aim: _____ / _____
correct errors (max.)

Name: High Vs. Low

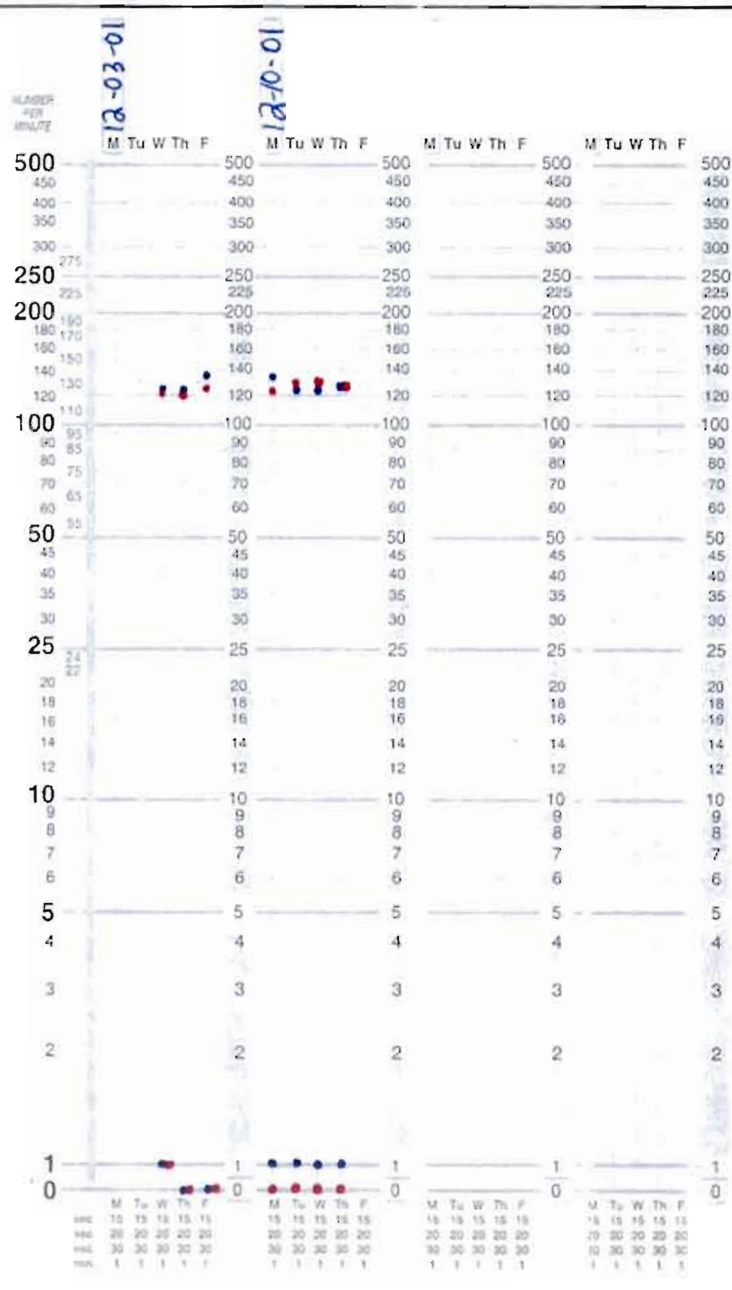
Skill: PS2

Possible Practice Changes

1- Build speed on previous slices and come back to this one later.
2- Shorten the timing period.
3- Make sure your tool skills are fast and accurate enough.
4- Practice longer (but don't work longer than 15 minutes on any one skill).
5- Stretch your hands and rest briefly between practices.
6- Try a worksheet or task that has just a few of the problems or items that are on the one that's been causing you difficulty - for example, if you have trouble getting faster on 0-9, try just writing a single digit.
7- Make sure that you write each day's aim on the today's aim lines before you start! (Write it lightly, then erase it when you are done with this chart for today.)
8- Work harder.

Remember!

- **For a 30-second timing,** double the total corrects and errors (multiply by 2 or add the numbers).
- **For a 20-second timing,** triple the total corrects and errors (multiply by 3 or add the numbers together, e.g., 15 + 15 + 15).
- **For a 15-second timing,** quadruple the total corrects and errors (multiply by 4 or add the numbers together, e.g., 10 + 10 + 10 + 10).



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