Why Tenth Graders Fail to Finish High School: A Dropout Typology Latent Class Analysis[1]

Alex J. Bowers[2] & Ryan Sprott[3]

ABSTRACT

A large percentage of the students who drop out of K-12 schools in the United States do so at the end of high school, at some point after grade 10. Yet we know little about the differences between different types of students who drop out of the end of high school. The purpose of this study is to examine a typology of high school dropouts from a large nationally representative dataset (ELS:2002) using latent class analysis (LCA). We found three significantly different types of dropouts; Quiet, Jaded, and Involved. Based on this typology of three subgroups, we discuss implications for future dropout intervention research, policy, and practice.

Keywords: Dropouts, dropout characteristics, dropout attitudes, dropout research, latent class analysis, longitudinal studies, high school, ELS:2002.

INTRODUCTION

A Focus on Dropping out of High School

Historically, much of the past literature on students who drop out of school K-12 has focused on the increased risk of dropping out that students incur during grades 7 through 9, especially in the transition from grade 8 to grade 9 (Alexander, Entwisle, & Kabbani, 2001; Allensworth & Easton, 2007; Balfanz, Herzog, & MacIver, 2007; Bowers, 2010b; Cohen & Smerdon, 2009; Neild, 2009; Roderick & Camburn, 1999; Rumberger, 1995). However, a recent area of emerging interest in dropout research that has received relatively little attention to date is a focus on students after grade 10 (Dalton, Glennie, & Ingles, 2009; Menzer & Hampel, 2009). Students who leave late in the school process comprise a large proportion of the dropout population, as many as half or more of the students who drop out (Allensworth & Easton, 2001; Roderick, 2006), and thus there is a need to study students who drop out of the end of high school. Yet the majority of past studies have focused on the risks of dropping out that arise during earlier grade levels, modeling the probability of whether a student will drop out at some point in the future (Allensworth & Easton, 2007; Balfanz, et al., 2007; Barrington & Hendricks, 1989; Battin-Pearson et al., 2000; Belcher & Hatley, 1994; Bowers, 2010a, 2010b; Dynarksi et al., 2008; Finn, 1989; Fitzsimmons, Cheever, Leonard, & Macunovich, 1969; Roderick & Camburn, 1999; Rumberger & Palardy, 2005), using a "dropout versus graduation" perspective. This single-category dropout research, usually modeled using binary logistic regression that restricts the analysis to a focus on drop out as a single category (yes/no), has provided a strong research base on when students drop out of school and the factors most associated with dropping out. However, this focus on dropping out as a single category has led to a lack of attention on if there are significant differences *among* students who drop out. Thus, rather than analyze "when" or "if" students drop out of high school, there is a need to focus on describing the differences between students who do drop out of high school in the U.S., termed "dropout typologies".

A Theory of Dropout Typologies

Although most dropout research contrasts dropping out and graduation, an alternative and much smaller research domain instead considers dropping out not as a single category, but rather as a mixture of different subgroups (a typology) of students who drop out for different reasons, comparing dropouts to dropouts. This dropout typology perspective describes students who drop out of school as separate subgroups, whose members drop out of school for different reasons (Balfanz, Hornig Fox, Bridgeland, & McNaught, 2009; Fortin, Marcotte, Potvin, Royer, & Joly, 2006; Janosz, LeBlanc, Boulerice, & Tremblay, 2000; Kronick & Hargis, 1998; Lessard et al., 2008; Menzer & Hampel, 2009; Voss, Wendling, & Elliott, 1966). The most effective prevention strategies are the ones that most closely relate to students' needs (Dynarksi et al., 2008; Wehlage, Rutter, Smith, Lesko, & Fernandez, 1989). Thus, the dropout typology perspective posits that subgroups of dropouts may differ from each other in their approach to schooling and need different intervention strategies.

To date, however, research considering a dropout typology has been fraught with methodological problems and lacks evidence of the number of dropout types that may exist in the population. Because little work has been done in this domain in the past, the studies have used qualitative methods, cluster analysis, or reviews of the literature to help describe an initial set of subgroups of a dropout typology. Hence, to some extent the potential number of these subgroups as reported in the past studies has been arbitrary. From two qualitative studies in which students were interviewed, Menzer and Hampel (2009) described a three to four group typology in their sample of 155 grade 12 students who dropped out from a single Delaware high school. Lessard et al. (2008) detailed multiple different types of dropouts from their interviews with 80 high school students from Quebec, Canada, categorizing them into a set of three, six, or fifteen different subgroups. Kronick and Hargis (1989) based their four groups on a reading of the literature. The two remaining peer-reviewed studies both

[2] Teachers College, Columbia University; Bowers@tc.edu; 525 W. 120th Street, New York, New York 10027. ORCID: 0000-0002-5140-6428
ResearcherID: C-1557-2013
[3] The University of Texas at San Antonio
Note: This document last updated on August 27, 2013

Table 1: Overview of past dropout typology categories.

	Chronically Struggling with Academics	*Bored with the Process*	*Disrupting School*	*Quiets*
Balfanz et al. (2009)	Failure to Succeed in School	Fade Outs	Push Outs	Life Events
Fortin et al. (2006)	School Adjustment Difficulty	Antisocial Covert Behavior	Social Adjustment Difficulty	Uninterested in School/Depressive
Janosz et al. (2000)	Low Achievers	Disengaged	Maladjusted	Quiets
Kronick & Hargis (1989)	Low-Achieving	High Achiever Pushouts	Low-Achiever Pushouts	Quiet Dropouts
Lessard et al. (2008)	Never Being in the Game	Dabbling in the Margins/Turning Away	Sabotaging the Journey	Living Invisibly
Menzer & Hampel (2009)	Struggler	Lackadaisical	Lackadaisical	Surprised/ Overwhelmed

used cluster analysis on samples of convenience from Quebec, Canada, with Janosz et al. (2000) analyzing 172 students from 1974 and 335 students from 1985 while Fortin et al. (2006) analyzed 810 students. While cluster analysis does empirically define "clusters" of students (i.e., typologies) based on their survey responses, researchers do not agree on how to determine if clusters are statistically significantly different (Cheung & Chan, 2005; Rencher, 2002; Romesburg, 1984; Zapala & Schork, 2006). Thus, we do not know how many dropout types actually exist in the population.

While given different names in different studies, from our reading of the literature these typologies fit with a theory of four main categories of students who are either 1) *Chronically Struggling with Academics*, 2) *Bored with the Process*, 3) *Disrupting School* or 4) *Quiets* (see Table 1). Table 1 shows these types in relationship to the five research studies (Fortin, et al., 2006; Janosz, et al., 2000; Kronick & Hargis, 1998; Lessard, et al., 2008; Menzer & Hampel, 2009) and a practice guide and report from Balfanz et al. (2009). Following the work of Kronick and Hargis (1998), we also synthesize them into one of four initial groupings. The first group is comprised of students *Chronically Struggling with Academics*. Known as students who fail to succeed in school, are low achievers, students who were never in the game, students with school adjustment difficulty, or strugglers, these students had very low academic achievement.

Students *Bored with the Process* form the second group. These students were known as fade outs, disengaged, high achiever pushouts, dabbling in the margins, turning away, antisocial covert, and lackadaisical. These students had some of the highest academic ability across the studies, but conversely also had the lowest commitment to school and displayed a general displeasure with the schooling process. The third group of students, students *Disrupting School,* were described as push outs, maladjusted, low-achiever pushouts, sabotaging the journey, or a social adjustment difficulty type. The lackadaisical group from Menzer and Hampel (2009) overlaps with the Bored with the Process group. The Disrupting School group, one of the most visible types of dropouts, were students who have a combination of low grades and misbehavior that disturbs school functioning. Students who have been called the "typical" or "traditional" dropout (Fortin et

al., 2006), these students visibly voice their frustration with academic and school processes through continued misbehavior in the classroom, and may be pushed out of school because of their low grades and misbehavior (Kronick & Hargis, 1998). Interestingly, while these students match the traditional conception of a student who drops out of school as someone who is frustrated with school and is low achieving, Fortin et al. (2006) demonstrated that this typology of students only accounted for about one third of the dropouts in their sample.

The final group, the *Quiets*, form the largest subgroup of dropouts in the studies, and are also termed living invisibly, life events, uninterested in school or depressive, and the surprised or overwhelmed dropout. Silent persistence identifies this group. These are students who appear most similar to graduates in behavior, yet, unlike graduates, persist through school without a strong attachment to the institution and with low grades. Although they may enjoy school, they do not have the support to continue the process when outside obstacles arise. These students may be susceptible to a rapid decline. They may quickly slip from school when pressured by outside responsibilities or family strife. Menzer and Hempel (2009) refer to this group as surprised or overwhelmed students. They note that these students may not graduate due to some mistake with their schedule or credit hours, and so non-graduation may come as a surprise to the student and their families, or perhaps the student is suffering through some type of turmoil that interrupts academic focus and success in the school, such as family or economic stress.

Although the dropout typology literature has provided multiple descriptions of different potential dropout categories, researchers nevertheless currently lack evidence as to how many dropout types exist. This matters because if significantly different subgroups of students drop out of school for different reasons, then interventions can be tailored to those students (Fortin, et al., 2006; Janosz, et al., 2000; Kronick & Hargis, 1998; Lessard, et al., 2008; Menzer & Hampel, 2009). As an example, students disrupting school or bored with the process may have very different needs from the quiet dropouts, and interventions that target their disruptive behavior or attempt to re-engage students with school could be wasted on the quiet or chronically struggling dropouts who are just as engaged in school as graduates. If true,

this lack of attention to date to the different types of students who drop out could help explain the lack of success historically with preventing student drop out.

However, it is equally possible that the majority of the research studies to date may be correct in conceiving of dropouts as a single group. In addition, none of the dropout typology studies to date have appropriately controlled for student background variables, such as student socio-economic status (SES), gender, and ethnicity, so no information is available on how different typologies vary by these important student attributes. Since the vast majority of the past dropout typology studies have focused on dated and intact samples of convenience from Quebec students, there is a need to extend this research into the U.S. context, using a more generalizable and recent sample. Additionally, to date none of the dropout typology studies, and few of the dropout studies from the broader literature, verify their models using longitudinal data that follows up with students in multiple years after they drop out of school, asking them why they decided to drop out and comparing their responses with the initial model. This type of data would help confirm that the proposed subgroups do exist and are statistically different.

Framework of the Study

The past literature on dropout typology theory has proposed that multiple subgroups of students who dropout may exist. However, the number of suroups has never been tested for significant fit with a large representative dataset. The purpose of the present study is to address this past issue through testing a typology of students who drop out of high school, using Latent Class Analysis (LCA) and a large recent nationally representative dataset of U.S. students. Latent class analysis, as a part of the larger mixture modeling methods literature, is well suited to testing for the extent to which hypotheses for a certain number of "mixtures" of distributions (a typology) across a set of variables is significant or not (Dolan, 2009; Goodman, 2002; McCutcheon, 2002). In the LCA literature, a typology is defined as "latent classes," a model of a certain number of classes is specified and tested, model fit is assessed, and, if the model is significant and fits well, then the responses of each of the latent classes (a typology) to the survey questions used to fit the model are described and named (Nylund, Asparouhov, & Muthén, 2007). In the present study, to inform dropout typology theory and address the past methodological issues, an LCA model was tested and fit. We then inform the model of multiple dropout types by assessing the responses of each type to a follow-up "dropout survey" conducted two years after what would have been on-time grade 12 graduation. Thus, this study is guided by three research questions:

1) How many different dropout types are significantly different using a large nationally representative U.S. dataset?
2) What are the specific characteristics that identify the typology of dropouts?
3) Two years after dropping out, what do students report as the reasons that they dropped out, and to what extent are these reasons associated with the different types?

METHODS

Sample

This study is a secondary analysis of the Education Longitudinal Study of 2002 (ELS:2002). Collected by the U.S. Department of

Education, National Center for Education Statistics (NCES), ELS:2002 is a nationally representative survey of about 15,400 United States high school students across 750 schools who were in grade 10 in the spring of 2002 (Ingles et al., 2004; Ingles et al., 2007; NCES, n.d.). In the 2002 base year (BY), NCES surveyed the students using survey questions pertaining to the students' experiences, background, demographics, and perceptions of their schools. In addition, students were tested in mathematics and reading and their grade point average (GPA) was collected. These students were surveyed again in 2004 during the first follow-up (F1) as well as in 2006 during the second follow-up (F2), four years after grade 10. We analyzed a subset of the full sample, namely students who had evidence of a dropout episode prior to high school graduation, between 2002 (when they were in grade 10) and 2006 (two years after a traditional four-year high school completion schedule), using the ELS:2002 variable F2EVERDO. Eleven percent of the students in the sample, or 1830 students, were designated as dropouts. Due to the requirements of the data analysis strategy discussed below of the need for complete data on background and demographic control variables, 360 students for whom we lacked background or demographic information were removed from the analysis. Thus, the sample size used for this study was n=1470. Differences between each variable's means, in the full dropout dataset and in the sub-sample used in the subsequent models, are detailed in the Appendices. There were few substantive differences between the full dropout sample and the sample used in the analyses. Due to requirements of confidentiality, all sample size numbers are rounded to the nearest ten.

Variables used in the analysis

For the data analysis strategy discussed below, we wished to include in the present analysis measures proposed in the past literature on dropouts and dropout typologies that capture the multiple pressures, perceptions, behaviors, and academic performance assessments that have been associated with dropping out. Our variable selection took into account the types of variables used in the past studies, significant variables described in the broader dropout literature, and the quality and availability of the data in ELS:2002. Variable minimum and maximum values, ELS:2002 variable labels, variable coding, citations to the relevant literature used to select the variables, and descriptives for the dichotomously scaled variables included in the analysis are reported in Appendix 1, background and demographic control variables are reported in Appendix 2, and continuous variables are reported in Appendix 3. For the dichotomously scaled variables, 20 survey items were included in the analysis. Additionally, 9 continuously scaled variables were included, as well as demographic and student background control variables. To aid in final model interpretation and following the recommendations of the LCA literature discussed below, all variables that were originally coded on a four item response scale of strongly disagree, disagree, agree, and strongly agree were recoded into 0/1 to represent disagree and agree only. In addition, following the recommendations of the LCA literature as well as the missing data methods literature (Graham, Cumsille, & Elvira, 2003; Muthén & Muthén, 2007), Full Information Maximum Likelihood (FIML) was used to impute missing data for the n=1470 sample. All variables had less than 10% missing data across all other variables except for hours per week spent reading outside of school (less than 14%), hours per week spent on extracurricular activities (less than 15%), and grade 10 GPA (less

than 25%). As noted by Graham, Cumsille, and Elvira (2003), FIML is robust under these conditions and is preferred.

Latent Class Analysis

Latent class analysis (LCA) has recently emerged from the data mining literature as a useful means to assess the extent to which a typology, or a set of "latent classes," fits the data (Dolan, 2009; Goodman, 2002; Jung & Wickrama, 2008; McCutcheon, 2002; Nylund et al., 2007). LCA is similar to cluster analysis in that subgroups of participant response patterns are identified from a large set of data. However, LCA has been shown to be superior to cluster analysis because LCA includes a hypothesis test for the number of latent classes. In addition, as an extension of generalized mixture modeling, which also includes structural equation modeling (SEM) and growth mixture modeling (GMM), LCA can include a range of data types as well as a set of control variables on the number of latent classes.
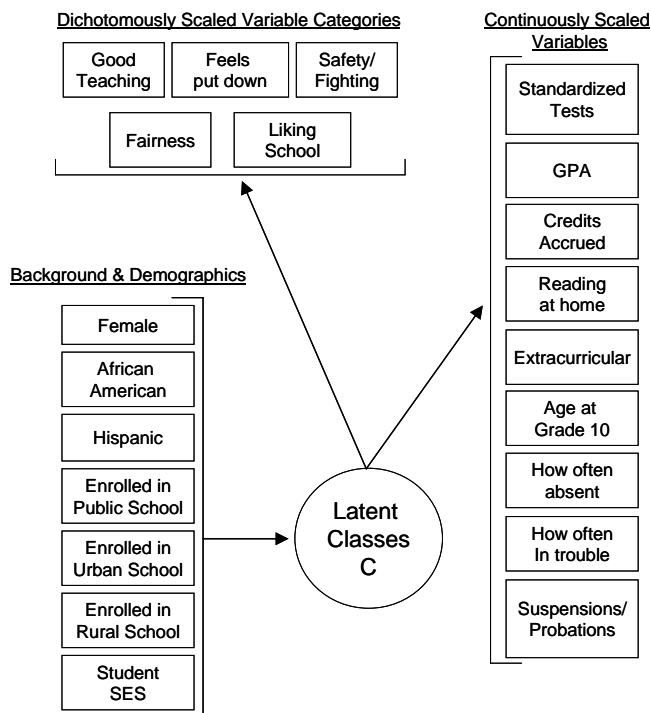

Figure 1: Latent Class Analysis (LCA) model for a dropout typology.

In brief, the concept behind LCA is the question of if a given set of distributions has a single mode or is a mixture of multiple modes, also known as "latent classes" of subgroups within the larger distribution. For the current study, we assessed an iterative set of LCA models, beginning with a one-class model, and moving to two-, three-, four-, and five class models in which the three-class model fit well (see results). MPLUS 5.21 was used to conduct the latent class analysis (Muthén & Muthén, 2007). Using the recommended nomenclature of the mixture modeling literature (Jung & Wickrama, 2008; Nylund, et al., 2007), Figure 1 details the components of the LCA model used here. The dependent variables fit to the models included all of the 2002 survey year 20 dichotomously scaled survey items described above, as well the nine continuous scaled survey items and

assessments, controlling for the seven background and demographic variables. In addition, since ELS:2002 was not a simple random sample, but rather used a complex probabilistic sampling strategy to allow for generalization to all 3 million students who were in grade 10 in the U.S. in 2002 (Ingles, et al., 2007; Strayhorn, 2009), applying sample weights to the LCA is recommended (Asparouhov, 2005). Thus, the normalized base-year student panel sample weight (BYEXPWT) was applied to the model. Because the normalized weight was used, the reported sample sizes are unchanged from an unweighted model. Additionally, following the nomenclature of past LCA studies (Schüz, Wurm, & Tesch-Römer, 2009), ANOVAs were conducted for the continuous variables across the identified latent classes to assess significant mean differences. We report statistically significant differences by Tukey's HSD post-hoc test with $p < 0.05$.

Finally, to assess the interpretation of each of the three classes identified in the final three-class LCA model, as well as to explore the reasons that students reported why they dropped out, survey responses from the second follow-up ELS:2002 "dropout survey" from 2006 (Ingles, et al., 2007) were analyzed. We analyzed these 2006 dropout survey responses by each of the latent class typology groups using Pearson's chi-square.

RESULTS

A Latent Class Analysis Model of a Grade 10 Dropout Typology

Following the recommendations of the mixture modeling literature (Jung & Wickrama, 2008; Lo, 2005; Lo, Mendell, & Rubin, 2001), and given the ambiguity of the number of dropout categories in the dropout typology literature that hypothesized multiple overlapping dropout types, we tested an iterative set of models, starting with a one-class model, assessing fit, and then proceeding to two-, three-, four- and five-class models. Neither the four- ($p=0.764$) nor the five-class ($p=0.765$) models fit the data. The three-class model fit the data well with $p=0.002$, AIC=86864.78, BIC=87478.45, and LMR=1144.72. Thus, as the first application of LCA to the dropout typology research domain using a nationally representative U.S. sample, the first finding of our analysis was that there were three significantly different types of dropouts. Based on the responses to the survey items below, we named the three dropout types Quiet, Jaded, and Involved. These subgroups represented 52.7%, 38.0% and 9.3% of the dropouts respectively.

Figure 2 details the response patterns of each of the three identified subgroups to the 20 dichotomously scaled 2002 survey items. The x-axis provides each of the items, grouped in the order described in the methods (see Appendix 1) while the y-axis presents the proportion of each group that responded "yes" or "agree" (see Figure 2). As described above, dropout typology theory is concerned with the differences between potentially different types of dropouts rather than with the difference between dropouts and graduates. However, while the approximately 14,000 students in the ELS:2002 sample who graduated from high school were not included in the model, the proportion of "yes" responses from graduates are also plotted in Figure 2 (grey line) to provide a comparison to help interpret the dropout subgroups identified in the LCA model, since many responses are similar to those of graduates. Such a comparison to graduate responses has been absent from much prior dropout typology research.
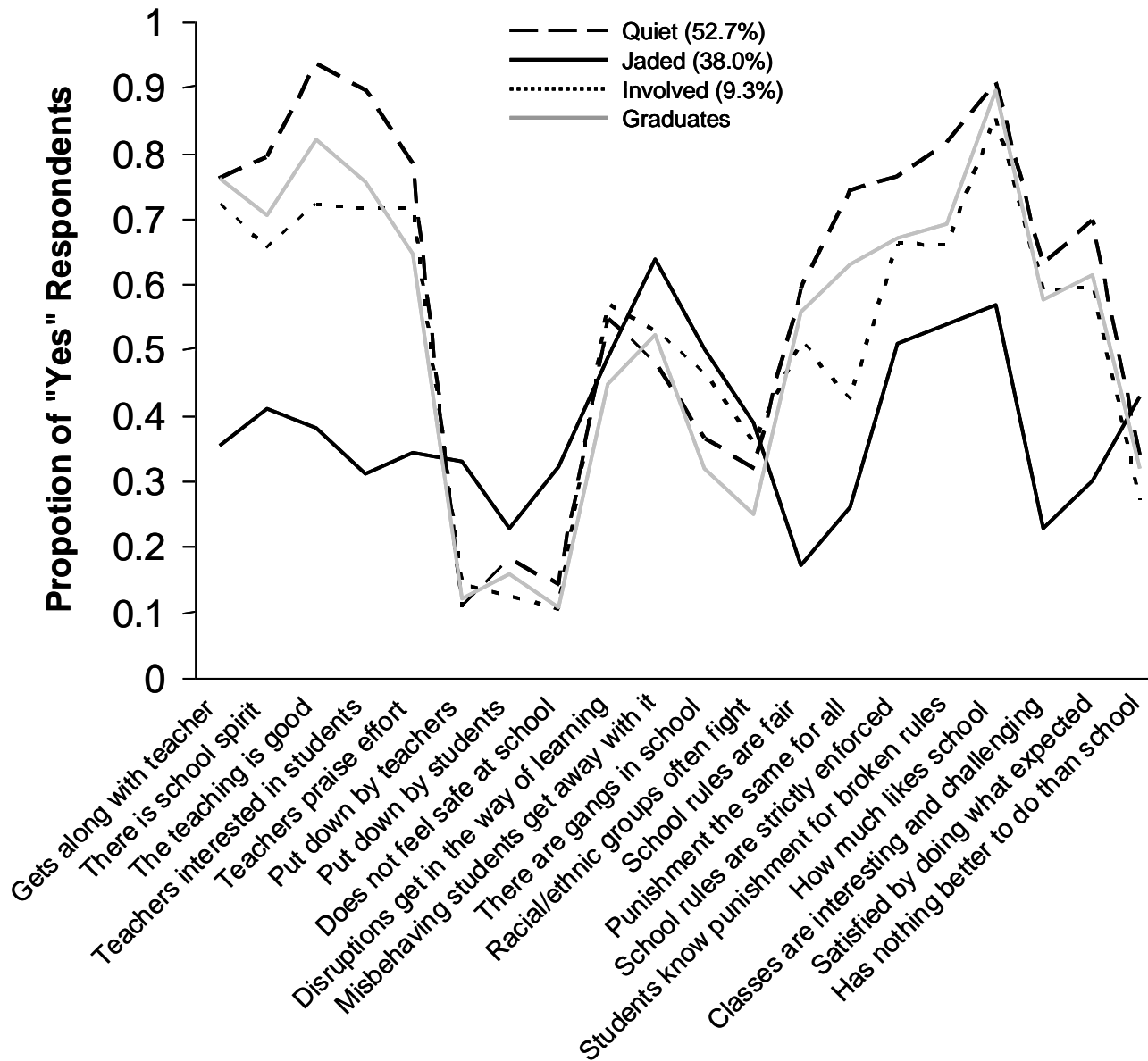
Figure 2: Responses of a three group typology of high school dropouts identified through LCA to dichotomously scaled survey items. Respondents answered yes/no or agree/disagree to each of the survey items listed on the x-axis in the spring of 2002 when they were in grade 10. The y-axis represents the proportion of respondents who answered yes to each question. Latent class analysis identified three types of dropouts, Quiet (dashed line), Jaded (solid black line), Involved (dotted line). Graduates (grey line) were not included in the LCA model but are provided here from the full sample as a comparison group. Overall, while the Jaded students represented a little over one third of the dropouts, were disaffected by schooling, and appeared to attend schools with discipline issues, Quiet students were very similar to Graduates on these questions and represented over half of the dropouts. As the smallest group, Involved students were similar to Quiets and Graduates.

As Figure 2 demonstrates, the LCA model identified three broad groups of students who dropped out after grade 10, two of which were highly similar to graduates. One is the Jaded group (Figure 2, solid line). Constituting a little over a third of the dropouts, the Jaded students indicated that they did not like school, that teachers were not as interested in them, that school rules were neither fair nor equally applied, and that they found their courses somewhat uninteresting and unchallenging. In contrast, the Quiet (Figure 2, dashed-line) and Involved groups (Figure 2, dotted line) appeared to be much more similar to graduates, responding similarly to the same questions in that about 70% or more of these two groups agreed that they thought that teachers were interested in them, that rules are equally enforced, and that they like school, with less than 20% agreeing that they were put down by teachers and students. Based upon these dichotomously scaled variables, the Quiet and Involved groups appear very similar to graduates, in that if Figure 2 were to be taken alone, there would appear to be only two groups. We turn next to examining the differences between the types based on the continuous and control variables that were also simultaneously modeled.

Bowers & Sprott (2012) *Why tenth graders fail to finish high school*

Table 2: Means of LCA continuous variables for the three identified groups in the dropout typology.

Variable	Quiet 52.7%	Jaded 38.0%	Involved 9.3%
Standardized test score composite math/reading	43.604[a] (0.483)	43.192[a] (0.519)	46.507[b] (1.265)
GPA for all grade 10 courses	1.712[a] (0.048)	1.410[b] (0.048)	2.005[c] (0.121)
Credits Accrued	10.820[a] (0.249)	9.004[b] (0.274)	12.188[c] (0.715)
How often goes to class without homework done	1.294[a] (0.043)	1.536[b] (0.050)	1.372[a] (0.088)
Hours per week spent on extracurricular activities	0.989[a] (0.094)	0.650[b] (0.132)	13.818[c] (0.698)
Age at Grade 10	16.491[ab] (0.035)	16.556[a] (0.044)	16.429[b] (0.076)
Hours per week spent reading outside of school	3.358[a] (0.232)	2.362[b] (0.250)	3.687[a] (0.543)
How many times absent from school during the first semester of grade 10	2.052[a] (0.061)	2.463[b] (0.072)	1.741[c] (0.138)
How many times got in trouble during the first semester of grade 10	0.689[a] (0.048)	1.602[b] (0.099)	0.995[c] (0.112)
How many times suspended/put on probation during the first semester of grade 10	0.218[a] (0.029)	0.547[b] (0.061)	0.215[a] (0.054)

Note: Standard errors are in parentheses.
Note: Subscripts that differ for each set of variable means (denoted by [a], [b], or [c]) indicate statistically significant differences by Tukey's HSD post-hoc test with $p < 0.05$.

Table 2 details the means and standard errors for each of the continuous variables included in the LCA model, disaggregated by each of the three types identified with significantly different means indicated by different subscripts for each row.

Using the past literature and the results presented in Figure 2 and Table 2, we named the three identified dropout types as Quiet, Jaded and Involved. As the largest percentage of the dropouts (52.7%), the Quiet students had fairly low test scores, grades, and credits accrued, went to class the least often without their homework done, participated in about one hour per week of extracurricular activities, read about three hours per week on average, were absent about two times the previous semester, got in trouble on average less than one time, and were rarely suspended or put on probation (see Table 2). The Quiet students were statistically similar in age to the other two subgroups. Quiet student test scores and grades were between the higher scores of the Involved and the lower scores of the Jaded students. These students were the most similar to those identified in the past dropout typology literature that has also identified a "Quiet" group (Fortin, et al., 2006; Janosz, et al., 2000; Kronick & Hargis, 1998) that appears similar to graduates, but performs somewhat lower on assessments. These students are "quiet" in that they have few discipline problems and do not participate often in extracurricular activities. These students are "unexpected" dropouts of whom the system usually is unaware (Bowers & Sprott, 2012), however they can be identified by their low grades.

In contrast to the Quiet type, a student fitting the Jaded type, the second largest typology group (38.0%), could be considered a "classic" or "traditional" type of dropout, in that Jaded appear to match descriptions of students generally expected to drop out of

school. The Jaded students dislike school, and appear to see it as a place where discipline is unevenly enforced (see Figure 2). In addition, the Jaded students on average have the lowest test scores, grades, and credits accrued, the lowest amount of reading and extracurricular activities per week, they go to class the most often without their homework done, are absent and in trouble the most, and were suspended or put on probation the most of the three types (see Table 2). The Jaded students were slightly older than the Involved students but statistically similar in age to the Quiet students. Notably, although intuition might suggest that the students most frustrated with school would constitute the majority of the students who drop out, this Jaded dropout typology was not the largest subgroup of dropouts. When considered with the point that this study analyzed a sample of students in the final years of high school, it stands to reason that the students most frustrated with school may have already dropped out in earlier grades, especially considering the long history of research demonstrating the challenges faced by many students from grades 7 through 10 (Abrams & Haney, 2004; Allensworth & Easton, 2007; Bowers, 2010a, 2010b; Neild, 2009; Neild & Balfanz, 2006; Neild & Farely, 2004; Neild, Stoner-Eby, & Furstenberg, 2008; Rumberger, 1995; Zvoch, 2006). However, our results do replicate and extend the findings of Fortin et al. (2006) who found that only about one third of their sample of 317 students who dropped out of Quebec schools fit what we call here the Jaded typology.

The final and smallest type of dropouts identified was the Involved group (9.3%). Overall, these students appeared similar in many ways to the Quiet students, in that their appraisal of the quality of teaching and discipline in their school, while slightly lower, is similar to that of the Quiets and Graduates (see Figure

Bowers & Sprott (2012) Why tenth graders fail to finish high school

Table 3: Percent responses to survey questions in 2006 about why the student dropped out of school, disaggregated by subgroup.

Variable	Quiet (52.7%)	Jaded (38.0%)	Involved (9.3%)
Left school because (n=800)			
Got a job	25.9	23.8	18.3
Did not like school	32.9	41.1	26.8*
Could not get along with teachers/students	23.7	38.2	21.1***
Pregnant/became parent	16.5	14.8	15.5
Had to support or care for family	23.7	21.7	21.1
Was suspended/expelled	13.2	23.9	22.5***
Did not feel safe	7.1	9.8	5.6
Did not feel belonged there	16.7	26.5	16.9**
Could not keep up with schoolwork	30.0	30.4	22.5
Was getting poor grades/failing school	35.0	42.9	25.4**
Could not work at the same time	22.1	20.9	19.7
Thought couldn't complete courses/pass test to graduate	25.0	30.0	14.1*
Thought it would be easier to get a GED	40.3	44.1	29.6
Missed too many school days	41.4	42.7	25.4*
School completion/plans			
High school completion status in 2006 – full diploma, n=1470	18.6	12.8	21.6**
Ever earned a GED, n=1470	28.7	35.3	41.9**
Ever applied to postsecondary school, n=1210	39.5	35.4	57.4***
Has or expects to graduate H.S. or obtain a GED, n=1240	89.0	88.8	87.4
Expects to graduate from 4yr college or graduate degree program at some point in the future, n=1240	36.0	32.4	46.2*

Note: Significant tests are Pearson chi-square: *$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$

2). Furthermore, while the Involved student's test scores, grades, credits, and hours per week devoted to reading outside of school were the highest of the three types, these students were more involved in extracurricular activities than either of the other two identified groups. The Involved students were slightly younger on average than the Jaded students but were similar in age to the Quiets. Students who drop out of school yet report high involvement in extracurricular activities have not received much attention in the previous literature. Here, "Involved" dropouts are a new type typified by low grades, test scores, and credits accrued, higher rates of being in trouble 1-2 times a semester, and participation in extracurricular activities.

As noted in Figure 1, we also controlled for multiple background and demographic variables in the LCA model. However, few of these control variables were significant in the model. In comparison to Quiets, Jaded students were 1.38 times less likely to be female and Involved students were 1.67 times less likely to be female. Jaded students were 3.68 times more likely to be from public schools and both Jaded and Involved students were more likely to be from higher SES families than Quiet students. No other controls were significant.

Why Students Dropped Out of High School

To verify the three typology model identified above and to gain a richer description of each type, we examined the pattern of responses on the ELS dropout survey, administered in 2006 (see Table 3). Conducted four years after the original grade 10 survey, the 2006 survey of these same students provides a unique longitudinal description of the reasons why these students

dropped out, as well as a means to assess each of the identified subgroups, outside of the original identification LCA model, which was based on 2002 data. This type of dropout typology model assessment has not been performed before. In addition, it captures students who returned to school and finished their high school degrees up to two years after on-time graduation, data that is rarely examined in the dropout literature. While the responses to the survey questions were not mutually exclusive (the students could indicate multiple reasons for why they left school), the pattern of significant differences across the typology helps to verify and further describe the differences between these three groups of students who dropped out of high school.

Overall, Table 3 reflects many of the differences in the three types identified from the 2002 survey data LCA model, and helps to confirm the overall model. The Quiet dropouts' responses demonstrated that they left school more often because they did not like school, they thought they couldn't complete courses or pass tests to graduate, and they had missed too many school days, like the Jaded students. However, overall, the Quiet subgroup indicated that they got along with teachers and students at nearly the same rates as the Involved group and similarly felt that they belonged. This reinforces the finding from the LCA model that low grades, low test scores, and higher rates of absences typify the Quiet group, but that these students are not disproportionally disaffected by school. The Jaded students reported that they left school more often because they could not get along with teachers, students, or both, did not feel that they belonged there, were getting poor grades or failing school, could not complete courses or pass tests, believed that it would be easier to get a GED, and missed too many school days. These 2006 responses by the Jaded
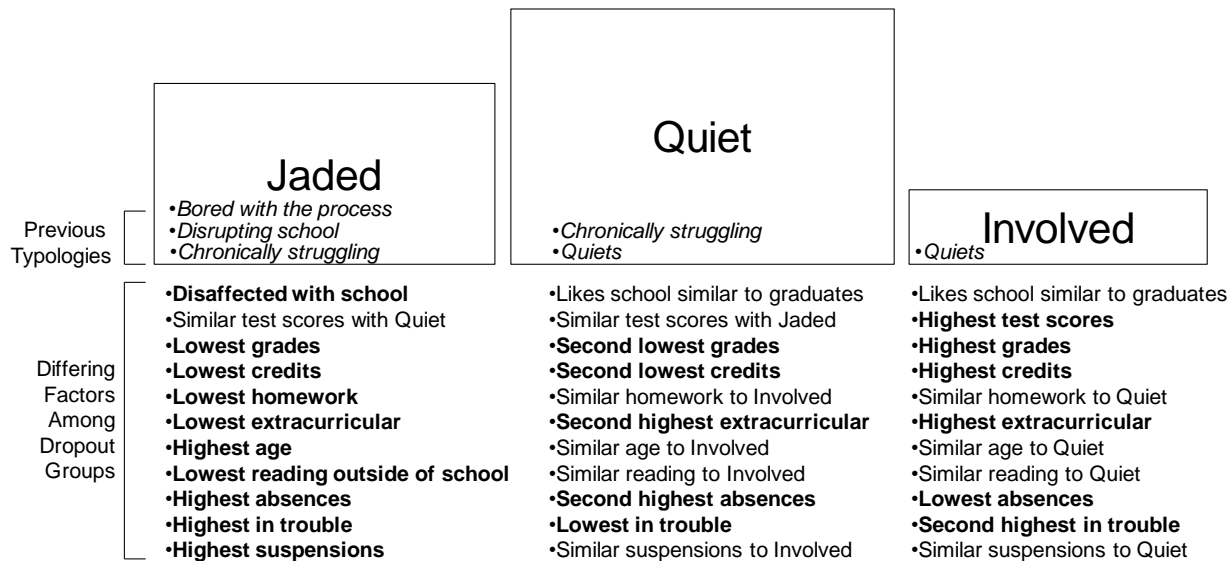
Previous Typologies	**Jaded** •*Bored with the process* •*Disrupting school* •*Chronically struggling*	**Quiet** •*Chronically struggling* •*Quiets*	**Involved** •*Quiets*
Differing Factors Among Dropout Groups	**•Disaffected with school** •Similar test scores with Quiet **•Lowest grades** **•Lowest credits** **•Lowest homework** **•Lowest extracurricular** **•Highest age** **•Lowest reading outside of school** **•Highest absences** **•Highest in trouble** **•Highest suspensions**	•Likes school similar to graduates •Similar test scores with Jaded **•Second lowest grades** **•Second lowest credits** •Similar homework to Involved **•Second highest extracurricular** •Similar age to Involved •Similar reading to Involved **•Second highest absences** **•Lowest in trouble** •Similar suspensions to Involved	•Likes school similar to graduates **•Highest test scores** **•Highest grades** **•Highest credits** •Similar homework to Quiet **•Highest extracurricular** •Similar age to Quiet •Similar reading to Quiet **•Lowest absences** **•Second highest in trouble** •Similar suspensions to Quiet

Figure 3: Comparison of the indicators of each of the subgroups in the identified dropout typology. Typology descriptors from the previous literature that align with each of the three types are listed at the bottom of each box. Major factors that differ across the typology are listed below each identified subgroup in bold. Size of box indicates proportion in the sample.

students confirms the finding from the 2002 LCA model that, as grade 10 students four years earlier, the Jaded type typifies the classic idea of the disengaged, disaffected, low-performing student who drops out.

In contrast to these two groups, the Involved dropouts reported some of the lowest responses for why they dropped out, from disliking school to getting low grades and missing too many school days. However, the Involved students reported similar levels to those of the Jaded students that they left school because they were suspended or expelled. This confirms the findings from the 2002 LCA model, demonstrating that the Involved type is typified by high levels of engagement with school, they are not disaffected by school, and get comparably higher grades and test scores, but do get in trouble more often. Strikingly, by 2006 the Involved dropouts were the group with the most graduates and GED recipients across the typology and over 50% of them had applied to post-secondary school. In addition, while close to 90% of all of the dropouts indicated that they expected to obtain their high school diploma or GED at some point, the Involved students reported the highest percentage of interest in graduating from a four-year college or graduate program.

DISCUSSION

The purpose of this study was to extend current dropout typology models by identifying a typology of students who drop out of the end of high school from a large nationally representative dataset. Using latent class analysis and controlling for multiple background and demographic variables, we identified three types of dropouts: Quiet, Jaded, and Involved. These findings are novel, and significantly extend prior dropout typology research for three main reasons. First, we identify three statistically different dropout types. Second, these results provide not only a rich description of each of the three types of students in grade 10, but also their opinions of why they left school and their completion status four years later. Such follow-up data is rarely analyzed in dropout studies. Third, the use of latent class analysis with a nationally representative U.S. dataset allowed us to model

Bowers & Sprott (2012) *Why tenth graders fail to finish high school*

appropriately the responses of the students to the survey and identify three significant types as the best model fit, as well as control for background and demographic variables. This is the first time this type of analysis has been performed in the dropout typology domain.

We have described three subgroups of students who drop out of the end of high school in an effort to provide a deeper description of students who drop out to help inform future policy, practice and research around dropouts and dropout interventions and prevention. Students who drop out of school have historically been viewed as a single category of students, yet our results, combined with the previous dropout typology literature, indicate that a wide variety of types of students drop out. Interventions cannot be "one size fits all." Many dropout interventions target a specific theory about why students drop out, such as a lack of connection to school (Finn, 1989). However, our results indicate that such "single target" interventions aimed at all students thought at risk of dropping out may not be very useful because they may have been applied to students who are not dropping out due to the theory behind the intervention. As noted by Menzer and Hampel, "adopting just one program or policy is unlikely to succeed in light of the multiple causes of failure" (2009, p.660). Here, while we hesitate to assign causality, we do show that students who drop out from the end of high school are not all alike, felt very different about high school across a broad array of survey questions, and eventually completed high school or a GED at very different rates.

Three Dropout Types

To date, little empirical work has been done to explain why and how different types of students drop out and what to do about it. Furthermore, researchers disagree about how many dropout types exist, and how they are defined. Here, rather than delineate a causal theory, we provide a descriptive model showing that specific subgroups of students may drop out of high school. Overall, our model identified three groups – Quiets, Jaded, and

Involved – who exhibited similarities and differences when compared to the groups found in the synthesis of previous typologies of students who are either Chronically Struggling with Academics, Bored with the Process, Disrupting, or Quiet. Figure 3 presents a summary of the three-group typology compared to the past four groups postulated in prior literature, and then highlights the main differences (Figure 3, bottom in bold) and similarities across the variables.

Conclusion

In conclusion, for students who drop out of the final years of high school, this study suggests that dropping out is not a single category of students, but rather is much more complex, in that we describe a three group typology of students who drop out. These three types of dropouts expressed different opinions of schooling in grade 10, participated and performed differently across a variety of activities and assessments, gave different responses four years later as to why they had dropped out, and completed their degrees at different rates. Policy and practice should focus first on these students who drop out of the end of high school and whose local communities have invested heavily in their education. Given the current lack of significant results of recent dropout intervention and prevention research (Dynarksi, et al., 2008; Dynarski, 2004; Dynarski & Gleason, 2002; Gleason & Dynarski, 2002; Hammond, Linton, Smink, & Drew, 2007; Rumberger, 2004a) an approach targeted at these students may be productive.

The typological approach indicates that at least three subgroups may exist, and that these three groups may need different intervention strategies. Quiet students may need more academic tutoring and connections to school to help increase their grades and decrease their absences and course failures, while Jaded students may need positive ways to connect with school to counteract their negative views of schooling. Involved students may need flexible schedules and alternative routes to graduation. In the end, almost 90% of each subgroup reported in the 2006 follow-up dropout survey that they would finish high school by some point in the future. This resilience in the face of adversity is an asset that should be used to help provide these students with the resources that they need to graduate on time. Our future work will focus on defining these needs and constructing intervention strategies that could be more effective in helping prevent these students from dropping out or help them obtain their high school diplomas after they have dropped out.

RECOMMENDED CITATION

REFERENCES

Abrams, L., & Haney, W. (2004). Accountability and the grade 9 to 10 transition: The impact on attrition and retention rates. In G. Orfield (Ed.), *Dropouts in America: Confronting the graduation rate crisis* (pp. 181-205). Cambridge, MA: Harvard Education Press.

Alexander, K. L., Entwisle, D. R., & Kabbani, N. S. (2001). The dropout process in life course perspective: Early risk

factors at home and school. *The Teachers College Record, 103*(5), 760-822.

Allensworth, E. M. (2005). Dropout rates after high-stakes testing in elementary school: A study of the contradictory effects of Chicago's efforts to end social promotion. *Education Evaluation and Policy Analysis, 27*(4), 341-364. doi: 10.3102/01623737027004341.

Allensworth, E. M., & Easton, J. Q. (2001). *Calculating a cohort dropout rate for the Chicago public schools: A technical research report*. Chicago, IL: Consortium on Chicago School Research.

Allensworth, E. M., & Easton, J. Q. (2005). *The on-track indicator as a predictor of High School graduation*: Consortium on Chicago School Research at the University of Chicago.

Allensworth, E. M., & Easton, J. Q. (2007). *What matters for staying on-track and graduating in Chicago public high schools: A close look at course grades, failures, and attendance in the freshman year*. Chicago: Consortium on Chicago School Research.

Asparouhov, T. (2005). Sampling weights in latent variable modeling. *Structural Equation Modeling: A Multidiscplinary Journal, 12*(3), 411-434. doi:10.1207/s15328007sem1203_4

Balfanz, R., Herzog, L., & MacIver, D. J. (2007). Preventing student disengagement and keeping students on the graduation path in urban middle-grades schools: Early identification and effective interventions. *Educational Psychologist, 42*(4), 223-235. doi:10.1080/00461520701621079

Balfanz, R., Hornig Fox, J., Bridgeland, J. M., & McNaught, M. (2009). *Grad Nation: A guidebook to help communities tackle the dropout crisis*. Washington, DC: America's Promise Alliance.

Barrington, B. L., & Hendricks, B. (1989). Differentiating characteristics of high school graduates, dropouts, and nongraduates. *Journal of Educational Research, 82*(6), 309-319.

Battin-Pearson, S., Abbott, R. D., Hill, K. G., Catalano, R. F., Hawkins, J. D., & Newcomb, M. D. (2000). Predictors of early high school dropout: A test of five theories. *Journal of Educational Psychology, 92*(3), 568-582. doi: 10.1037/0022-0663.92.3.568

Belcher, D. C., & Hatley, R. V. (1994). A dropout prediction model that highlights middle level variables. *Research in Middle Level Education, 18*(1), 67-78.

Bowers, A.J. (2009) Reconsidering Grades as Data for Decision Making: More than Just Academic Knowledge. *Journal of Educational Administration, 47*(5), 609-629. doi:10.1108/09578230910981080.

Bowers, A.J. (2010a) Analyzing the Longitudinal K-12 Grading Histories of Entire Cohorts of Students: Grades, Data

Driven Decision Making, Dropping Out and Hierarchical Cluster Analysis. *Practical Assessment, Research & Evaluation, 15*(7), 1-18. http://pareonline.net/pdf/v15n7.pdf

Bowers, A.J. (2010b) Grades and Graduation: A Longitudinal Risk Perspective to Identify Student Dropouts. *The Journal of Educational Research, 103*(3), 191-207. doi:10.1080/00220670903382970.

Bowers, A.J. (2011) What's in a Grade? The Multidimensional Nature of What Teacher Assigned Grades Assess in High School. *Educational Research & Evaluation, 17*(3), 141-159. doi: 10.1080/13803611.2011.597112.

Bowers, A.J., Sprott, R. (2012) Examining the Multiple Trajectories Associated with Dropping Out of High School: A Growth Mixture Model Analysis. *The Journal of Educational Research, 105*(3), 176-195. doi:10.1080/00220671.2011.552075.

Cheung, M. W. L., & Chan, W. (2005). Classifying correlation matrices into relatively homogeneous subgroups: A cluster analytic approach. *Educational and Psychological Measurement, 65*(6), 954-979. doi: 10.1177/0013164404273946

Cohen, J. S., & Smerdon, B. A. (2009). Tightening the dropout tourniquet: Easing the transition from middle to high school. *Preventing School Failure, 53*(3), 177-184. doi:10.3200/PSFL.53.3.177-184

Dalton, B., Glennie, E., & Ingles, S. J. (2009). *Late high school dropouts: Characteristics, experiences, and changes across cohorts*. Retrieved from http://nces.ed.gov/pubs2009/2009307.pdf.

Dolan, C. V. (2009). Structural equation mixture modeling. In R. E. Millsap & A. Maydeu-Olivares (Eds.), *The SAGE handbook of quantitative methods in psychology* (pp. 568-591). Thousand Oaks, CA: SAGE Publications.

Dynarksi, M., Clarke, L., Cobb, B., Finn, J., Rumberger, R. W., Smink, J., et al. (2008). *Dropout prevention: A practice guide* (No. NCEE 2008-4025). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.

Dynarski, M. (2004). Interpreting the evidence from recent federal evaluations of dropout-prevention programs: The state of scientific research. In G. Orfield (Ed.), *Dropouts in America: Confronting the graduation rate crisis* (pp. 255-268). Cambridge, MA: Harvard Education Press.

Dynarski, M., & Gleason, P. (2002). How can we help? What we have learned from recent federal dropout prevention evaluations. *Journal of Education for Students Placed at Risk, 2002*(1), 43-69. doi:10.1207/S15327671ESPR0701_4

Ekstrom, R. B., Goertz, M. E., Pollack, J. M., & Rock, D. A. (1986). Who drops out of high school and why?

Bowers & Sprott (2012) *Why tenth graders fail to finish high school*

Findings from a national study. *Teachers College Record, 87*(3), 356-373.

Finn, J. D. (1989). Withdrawing from school. *Review of Educational Research, 59*(2), 117-142.

Fitzsimmons, S. J., Cheever, J., Leonard, E., & Macunovich, D. (1969). School failures: Now and tomorrow. *Developmental Psychology, 1*(134-146).

Fortin, L., Marcotte, D., Potvin, P., Royer, E., & Joly, J. (2006). Typology of students at risk of dropping out of school: Description by personal, family and school factors. *European Journal of Psychology of Education, 21*(4), 363-383. doi: 10.1007/BF03173508

French, D. C., & Conrad, J. (2001). School dropout as predicted by peer rejection and antisocial behavior. *Journal of Research on Adolescence, 11*(3), 225-244. doi: 10.1111/1532-7795.00011

Gleason, P., & Dynarski, M. (2002). Do we know whom to serve? Issues in using risk factors to identify dropouts. *Journal of Education for Students Placed at Risk, 7*(1), 25-41. doi:10.1207/S15327671ESPR0701_3

Goodman, L. A. (2002). Latent class analysis: The emperical study of latent types, latent variables, and latent structures. In J. A. Hagenaars & A. L. McCutcheon (Eds.), *Applied latent class analysis* (pp. 3-55). Cambridge UK: Cambridge University Press.

Graham, J. W., Cumsille, P. E., & Elvira, E.-F. (2003). Methods for handling missing data. In I. B. Weiner, J. A. Schinka & W. F. Velicer (Eds.), *Handbook of psychology: Volume 2 Research methods in psychology*. New York, NY: John Wiley & Sons.

Hammond, C., Linton, D., Smink, J., & Drew, S. (2007). *Dropout risk factors and exemplary programs: A technical report*. Clemson, S.C.: National Dropout Prevention Center.

Hauser, R. M., Simmons, S. J., & Pager, D. I. (2004). High school dropout, race/ethnicity, and social background from the 1970s to the 1990s. In G. Orfield (Ed.), *Dropouts in America: Confronting the graduation rate crisis* (pp. 85-106). Cambridge, MA: Harvard Education Press.

Ingles, S. J., Pratt, D. J., Rogers, J. E., Siegel, P. H., Stutts, E. S., & Owings, J. A. (2004). *Education longitudinal study of 2002: Base year data file user's manual*. Washington, D.C.: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

Ingles, S. J., Pratt, D. J., Wilson, D., Burns, L. J., Currivan, D., Rogers, J. E., et al. (2007). *Education longitudinal study of 2002: Base-year to second follow-up data file documentation*. Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

Janosz, M., LeBlanc, M., Boulerice, B., & Tremblay, R. E. (2000). Predicting different types of school dropouts: A typological approach with two longitudinal samples. *Journal of Educational Psychology, 92*(1), 171-190. doi: 10.1037/0022-0663.92.1.171

Jung, T., & Wickrama, K. A. S. (2008). An introduction to latent class growth analysis and growth mixture modeling. *Social and Personality Psychology Compass, 2*(1), 302-317. doi: 10.1111/j.1751-9004.2007.00054.x

Kronick, R. F., & Hargis, C. H. (1998). *Dropouts: Who drops out and why - and the recommended action* (2 ed.). Springfield, IL: Charles C. Thomas.

Lee, V. E., & Burkam, D. T. (2003). Dropping out of high school: The role of school organization and structure. *American Educational Research Journal, 40*(2), 353-393. doi: 10.3102/00028312040002353

Lessard, A., Butler-Kisber, L., Fortin, L., Marcotte, D., Potvin, P., & Royer, E. (2008). Shades of disengagement: High school dropouts speak out. *Social Psychology of Education, 11*(1), 25-42. doi: 10.1007/s11218-007-9033-z

Lo, Y. (2005). Likelihood ratio tests of the number of components in a normal mixture with unequal variances. *Statistics & probability letters, 71*(3), 225-235. doi: 10.1016/j.spl.2004.11.007

Lo, Y., Mendell, N. R., & Rubin, D. B. (2001). Testing the number of components in a normal mixture. *Biometrika, 88*(3), 767-778. doi: 10.1093/biomet/88.3.767

Losen, D. J. (2004). Graduation rate accountability under the No Child Left Behind Act and the disparate impact on students of color. In G. Orfield (Ed.), *Dropouts in America: Confronting the graduation rate crisis* (pp. 41-56). Cambridge, MA: Harvard Education Press.

Mahoney, J. L. (2000). School extracurricular activity participation as a moderator in the development of antisocial patterns. *Child Development, 71*(2), 502-516. doi: 10.1111/1467-8624.00160

McCutcheon, A. L. (2002). Basic concepts and procedures in single- and multiple-group latent class analysis. In J. A. Hagenaars & A. L. McCutcheon (Eds.), *Applied latent class analysis* (pp. 56-87). Cambridge UK: Cambridge University Press.

McNeil, L. M., Coppola, E., & Radigan, J. (2008). Avoidable losses: High-stakes accountability and the dropout crisis. *Education Policy Analysis Archives, 16*(3).

Menzer, J. D., & Hampel, R. L. (2009). Lost at the last minute. *Phi Delta Kappan, 90*(9), 660-664.

Muthén, L. K., & Muthén, B. O. (2007). *Mplus: Statistical analysis with latent variables user's guide* (5th ed.). Los Angles, CA: Muthén & Muthén.

Bowers & Sprott (2012) *Why tenth graders fail to finish high school*

NCES. (n.d.). Education longitudinal study of 2002 (ELS:2002). from http://www.nces.ed.gov/surveys/els2002/

Neild, R. C. (2009). Falling off track during the transition to high school: What we know and what can be done. *The Future of Children, 19*(1), 53-76.

Neild, R. C., & Balfanz, R. (2006). *Unfulfilled promise: The dimensions and characteristics of Philadelphia's dropout crisis, 2000-2005*. Philadelphia: Philadelphia Youth Transitions Collaborative.

Neild, R. C., & Farely, E. (2004). Whatever happened to the class of 2000? The timing of dropout in Philadelphia's schools. In G. Orfield (Ed.), *Dropouts in America: Confronting the graduation rate crisis* (pp. 207-220). Cambridge, MA: Harvard Education Press.

Neild, R. C., Stoner-Eby, S., & Furstenberg, F. (2008). Connecting entrance and departure: The transition to ninth grade and high school dropout. *Education and Urban Society, 40*(5), 543-569. doi: 10.1177/0013124508316438

Nylund, K. L., Asparouhov, T., & Muthén, B. O. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation Modeling: A Multidiscplinary Journal, 14*(4), 535-569. doi:10.1080/10705510701575396

Ream, R. K., & Rumberger, R. W. (2008). Student engagement, peer social capital, and school dropout among Mexican American and Non-Latino White students. *Sociology of Education, 81*(2), 109-139. doi: 10.1177/003804070808100201

Rencher, A. C. (2002). *Methods in multivariate analysis* (2nd ed.). Hoboken: John Wiley & Sons, Inc.

Roderick, M. (2006). *Closing the aspirations-attainment gap: Implications for high school reform, A commentary from Chicago*. Paper presented at the MDRC High School Reform Conference "Improving High Schools: Putting Knowledge to Work". Retrieved from http://eric.ed.gov/PDFS/ED491184.pdf

Roderick, M., & Camburn, E. (1999). Risk and recovery from course failure in the early years of High School. *American Educational Research Journal, 36*(2), 303-343. doi: 10.3102/00028312036002303

Romesburg, H. C. (1984). *Cluster analysis for researchers*. Belmont, CA: Lifetime Learning Publications.

Rumberger, R. W. (1995). Dropping out of middle school: A multilevel analysis of students and schools. *American Educational Research Journal, 32*(3), 583-625. doi: 10.3102/00028312032003583

Rumberger, R. W. (2004a). What can be done to reduce the dropout rate? In G. Orfield (Ed.), *Dropouts in America: Confronting the graduation rate crisis* (pp. 243-267). Cambridge, MA: Harvard Education Press.

Rumberger, R. W. (2004b). Why students drop out of school. In G. Orfield (Ed.), *Dropouts in America: Confronting the graduation rate crisis* (pp. 131-156). Cambridge, MA: Harvard Education Press.

Rumberger, R. W., & Palardy, G. J. (2005). Test scores, dropout rates, and transfer rates as alternative indicators of high school performance. *American Educational Research Journal, 42*(1), 3-42. doi: 10.3102/00028312042001003

Schüz, B., Wurm, S., & Tesch-Römer, C. (2009). Health and subjective well-being in later adulthood: Different health states - different needs? *Applied Psychology: Health and Well-Being, 1*(1), 23-45. doi: 10.1111/j.1745-7254.2007.00657.x-i1

Strayhorn, T. L. (2009). Acessing and analyzing national databases. In T. J. Kowalski & T. J. Lasley (Eds.), *Handbook of data-based decision making in education* (pp. 105-122). New York, NY: Routledge.

Swanson, C. B. (2004). Sketching a portrait of public high school graduation: Who graduates? Who doesn't? In G. Orfield (Ed.), *Dropouts in America: Confronting the graduation rate crisis* (pp. 13-40). Cambridge, MA: Harvard Education Press.

Voss, H. L., Wendling, A., & Elliott, D. S. (1966). Some types of high school dropouts. *The Journal of Educational Research, 59*(8), 363-368.

Wehlage, G. G., Rutter, R. A., Smith, G. A., Lesko, N., & Fernandez, R. R. (1989). *Reducing the risk: Schools as communities of support*. Philadelphia, PA: The Falmer Press.

Zapala, M. A., & Schork, N. J. (2006). Multivariate regression analysis of distance matrices for testing associations between gene expression patterns and related variables. *Proceedings of the National Academy of Sciences, 103*(51), 19430-19435. doi: 10.1073/pnas.0609333103

Zvoch, K. (2006). Freshman year dropouts: Interactions between student and school characteristics and student dropout status. *Journal of Education for Students Placed at Risk, 11*(1), 97-117. doi:10.1207/s15327671espr1101_6

APPENDICIES

Appendix 1: Descriptives of dichotomous variables used in the analysis.

Variable	ELS:2002 Variable	Min	Max	Model Sub-Sample			Original Sample		
				n	Mean	SD	n	Mean	SD
Good teaching- (Allensworth & Easton, 2007; Fortin, et al., 2006; Lee & Burkam, 2003)									
Student gets along well with teachers	BYS20A	0	1	1470	0.61	0.49	1570	0.61	0.49
There is real school spirit	BYS20B	0	1	1470	0.63	0.48	1550	0.62	0.49
The teaching is good	BYS20E	0	1	1470	0.70	0.46	1550	0.70	0.46
Teachers are interested in students	BYS20F	0	1	1470	0.65	0.48	1540	0.66	0.48
Teachers praise effort	BYS20G	0	1	1470	0.60	0.49	1550	0.61	0.49
Feels put down -_ (Fortin, et al., 2006; French & Conrad, 2001; Janosz, et al., 2000; Rumberger & Palardy, 2005)									
In class often feels put down by teachers	BYS20H	0	1	1470	0.20	0.40	1560	0.21	0.41
In class often feels put down by students	BYS20I	0	1	1470	0.19	0.40	1560	0.19	0.40
Safety/Fighting - (Fortin, et al., 2006; Janosz, et al., 2000; Lessard, et al., 2008; Rumberger & Palardy, 2005)									
Does not feel safe at this school	BYS20J	0	1	1470	0.21	0.41	1550	0.20	0.40
Disruptions get in the way of learning	BYS20K	0	1	1470	0.53	0.50	1560	0.53	0.50
Misbehaving students often get away with it	BYS20L	0	1	1470	0.55	0.50	1560	0.55	0.50
There are gangs in this school	BYS20M	0	1	1470	0.43	0.50	1550	0.41	0.49
Racial/ethnic groups often fight	BYS20N	0	1	1470	0.35	0.48	1560	0.35	0.48
Fairness - (Fortin, et al., 2006; Rumberger & Palardy, 2005)									
School rules are fair	BYS21B	0	1	1470	0.42	0.49	1540	0.43	0.50
Punishment the same no matter who you are	BYS21C	0	1	1470	0.52	0.50	1550	0.55	0.50
School rules are strictly enforced	BYS21D	0	1	1470	0.65	0.48	1560	0.66	0.47
Students know the punishment for broken rules	BYS21E	0	1	1470	0.69	0.46	1560	0.70	0.46
Liking school - (Ekstrom, Goertz, Pollack, & Rock, 1986; Fortin, et al., 2006; Janosz, et al., 2000; Lessard, et al., 2008; Rumberger, 2004b)									
How much likes school	BYS28	0	1	1470	0.77	0.42	1570	0.79	0.41
Classes are interesting and challenging	BYS27A	0	1	1470	0.47	0.50	1560	0.49	0.50
Satisfied by doing what is expected in class	BYS27B	0	1	1470	0.53	0.50	1560	0.56	0.50
Has nothing better to do than school	BYS27C	0	1	1470	0.37	0.48	1560	0.37	0.48

Appendix 2: Descriptives of student background variables used in the analysis.

Variable		Min	Max	Model Sub-Sample			Original Sample		
				n	Mean	SD	n	Mean	SD
Female	BYSEX, 0=male, 1=female	0	1	1470	0.41	0.49	1705	0.43	0.50
African American	BYRACE_2=1	0	1	1470	0.28	0.45	1490	0.27	0.44
Hispanic	BYS15=1	0	1	1470	0.15	0.36	1640	0.23	0.42
Public	BYCTRL=1, student attended a public school.	0	1	1470	0.97	0.16	1830	0.94	0.25
Urban	BYURBAN=1, student attended an urban school. Suburban is the reference group	0	1	1470	0.33	0.47	1830	0.37	0.48
Rural	BYURBAN=3, student attended a rural school. Suburban is the reference group	0	1	1470	0.21	0.40	1830	0.19	0.40
SES	F1SESR, standardized restricted-data socio-economic status composite	-2.12	1.68	1470	-0.36	0.63	1830	-0.41	0.65

Cited literature: (Alexander, et al., 2001; Hauser, Simmons, & Pager, 2004; Janosz, et al., 2000; Ream & Rumberger, 2008; Rumberger & Palardy, 2005; Swanson, 2004)

Appendix 3: Descriptives of continuous variables used in the analysis.

Variable	ELS:2002 Variable	Min	Max	Model Sub-Sample			Original Sample			Cited Literature
				n	Mean	SD	n	Mean	SD	
Standardized test composite score math/reading grade 10	BYTXCSTD	22.50	77.57	1470	43.72	8.70	1780	43.74	8.71	(Losen, 2004; McNeil, Coppola, & Radigan, 2008; Rumberger & Palardy, 2005)
GPA for all grade 10 courses	F1RGP10	0	4	1470	1.60	0.81	1470	1.65	0.85	(Allensworth & Easton, 2007; Barrington & Hendricks, 1989; Bowers, 2009, 2010a, 2010b, 2011; Bowers & Sprott, 2012; Fortin, et al., 2006; Janosz, et al., 2000; Kronick & Hargis, 1998; Rumberger & Palardy, 2005)
High School Credits Accrued	F1RHTAC in Carnegie units	0	28	1470	10.21	4.83	1510	10.28	4.90	(Allensworth & Easton, 2005; Roderick, 2006)
Hours per week spent reading outside of school	BYS43	0	21	1470	3.00	4.67	1530	2.93	4.53	(Finn, 1989; Janosz, et al., 2000; Mahoney, 2000)
Hours per week spent on extracurricular activities	BYS42	0	21	1470	2.11	4.43	1510	2.20	4.38	(Finn, 1989; Janosz, et al., 2000; Mahoney, 2000)
Age	BYDOB_P, recoded to years old as of Sept 1, 2001	14	19	1470	16.51	0.79	1660	16.51	0.80	(Allensworth, 2005; Roderick, 2006)
How often goes to class without homework done	BYS38C, 0=never, 1=seldom, 2=often, 3=usually	0	3	1470	1.40	0.92	1530	1.38	0.93	(Ekstrom, et al., 1986; Fortin, et al., 2006)
How many times absent from school during the first semester of grade 10	BYS24C, 0=never, 1=1-2 times, 2= 3-6 times, 3= 7-9 times, 4=10 or more times	0	4	1470	2.19	1.27	1540	2.14	1.29	(Alexander, et al., 2001; Balfanz, et al., 2007; Fortin, et al., 2006; Janosz, et al., 2000; Rumberger & Palardy, 2005)
How many times got in trouble during the first semester of grade 10	BYS24D, 0=never, 1=1-2 times, 2= 3-6 times, 3= 7-9 times, 4=10 or more times	0	4	1470	1.08	1.18	1560	1.06	1.17	(Balfanz, et al., 2007; Fortin, et al., 2006; Janosz, et al., 2000; Lessard, et al., 2008; Rumberger & Palardy, 2005)
How many times suspended/put on probation during the first semester of grade 10	BYS24F, 0=never, 1=1-2 times, 2= 3-6 times, 3= 7-9 times, 4=10 or more times	0	4	1470	0.35	0.76	1560	0.50	0.90	(Balfanz, et al., 2007; Fortin, et al., 2006; Janosz, et al., 2000)

Bowers & Sprott (2012) *Why tenth graders fail to finish high school*

SUPPLEMENTAL MATERIAL

The below supplemental material are provided as a supplement to the manuscript. This information was not included in the final full JESPAR publication but is included here in the preprint. To cite the below information, please cite it as an online document.

Bowers, A.J., Sprott, R.A. (2012) Why Tenth Graders Fail to Finish High School: A Dropout Typology Latent Class Analysis. The *Journal of Education for Students Placed at Risk (JESPAR), 17*(3), 129-148. Online Supplemental Material retrieved from: http://hdl.handle.net/10022/AC:P:21448

Included in the below Supplement:

- **Supplement Figure S1:** Distributions of continuous variables from the LCA with graduates as a comparison group.

- **Supplement Figure S2:** Distributions of continuous variables from the LCA with graduates as a comparison group.

- **Supplement Table S1:** Means and odds ratios for LCA background control variables with Quiet as the reference group

- **MPLUS Code**
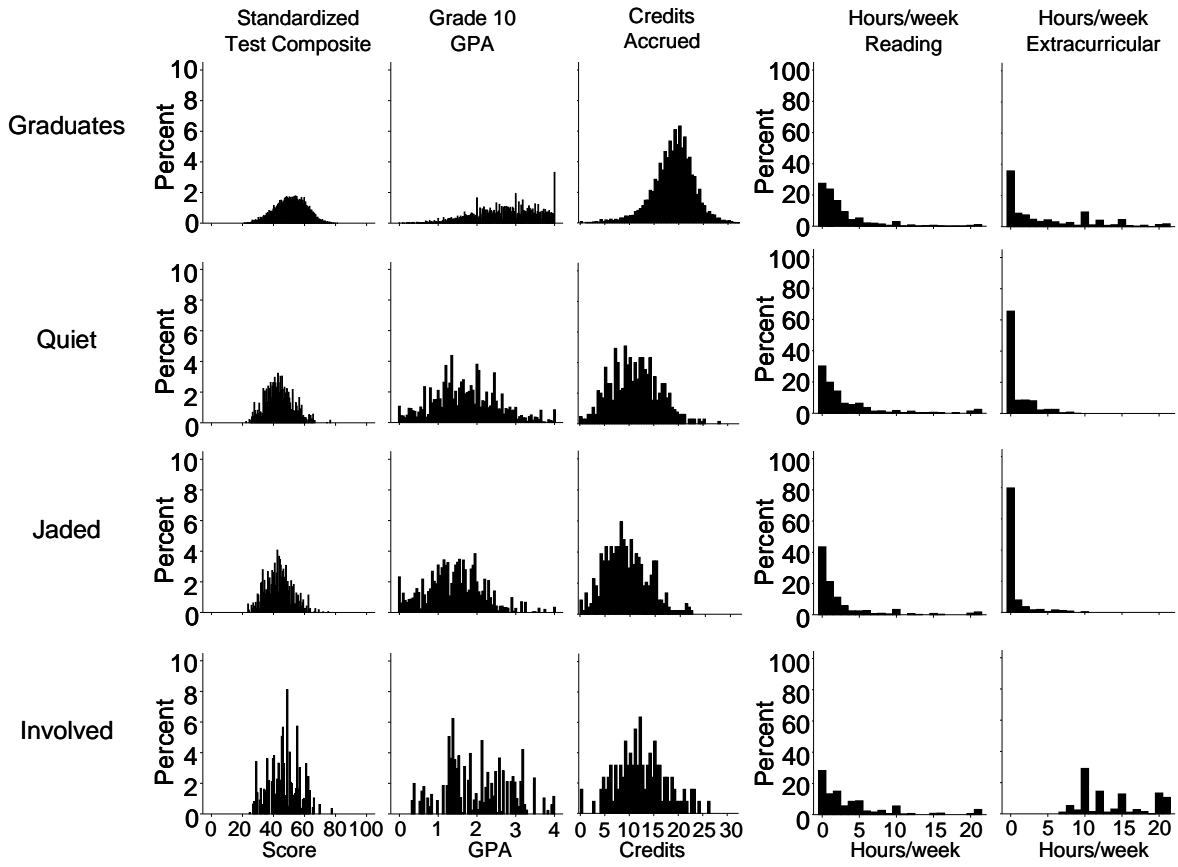
Supplement Figure S1: Distributions of continuous variables from the LCA with graduates as a comparison group.
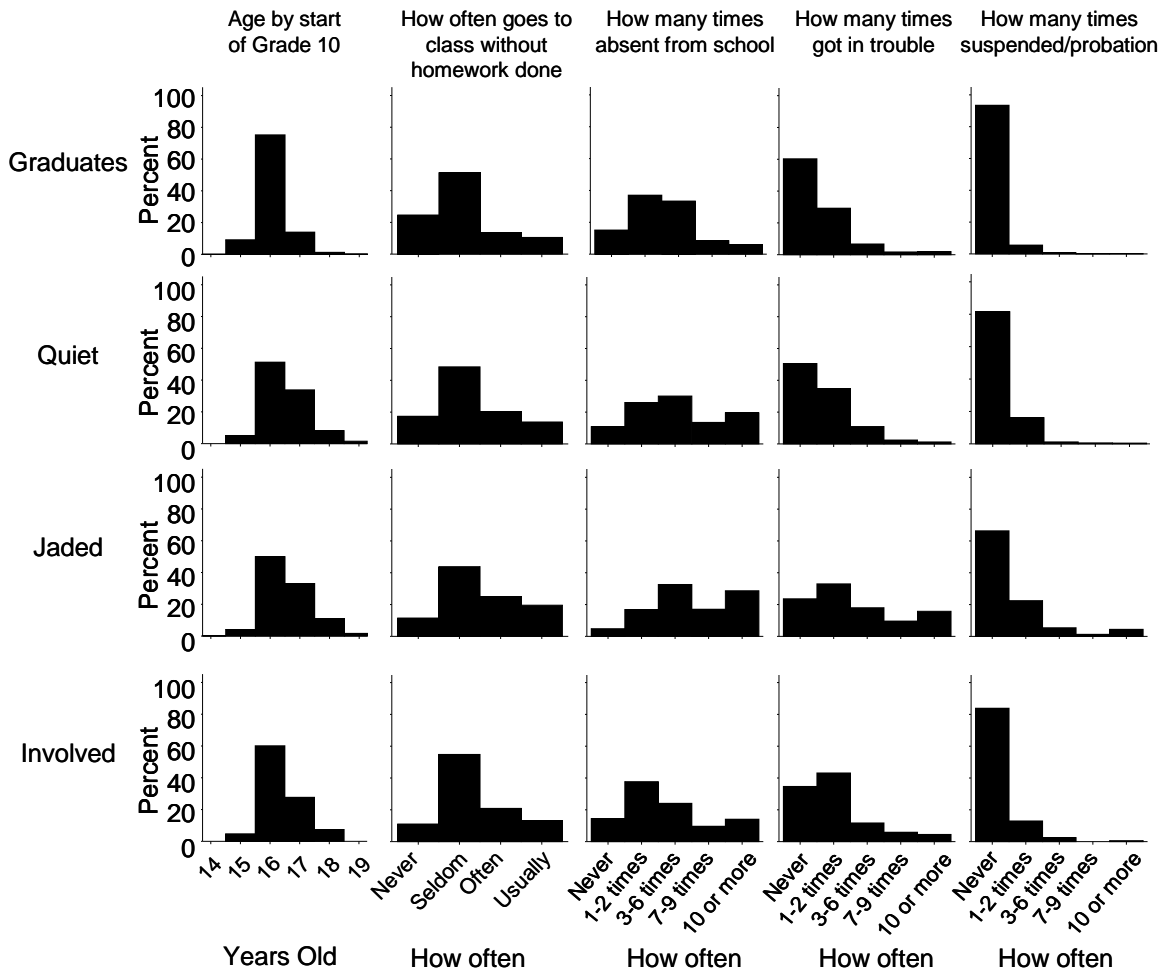
Supplement Figure S2: Distributions of continuous variables from the LCA with graduates as a comparison group.

Supplement Table S1: Means and odds ratios for LCA background control variables with Quiet as the reference group.

Variable	Quiet 52.7%		Jaded 38.0%		Involved 9.3%	
	Mean	Odds	Mean	Odds	Mean	Odds
Student is female	0.48	---	0.37	0.724*	0.33	0.600*
Student is African American	0.27	---	0.26	1.006	0.22	0.955
Student is Hispanic	0.17	---	0.12	0.828	0.08	0.623
Student's school is public	0.93	---	0.96	3.684***	0.80	0.492
Student's school is urban	0.35	---	0.31	0.908	0.35	1.091
Student's school is rural	0.21	---	0.21	0.839	0.24	1.026
Student socio-economic status	-0.44	---	-0.29	1.557***	-0.13	1.900***

Note: *$p \leq 0.05$, ***$p \leq 0.001$

MPLUS Code:

```
Title:      LCA Dropout Model
Data:       File = C:\data\ELS\LCA_01.dat
VARIABLE:   NAMES       = ID
                        BYS20A BYS20B BYS20E BYS20F BYS20G BYS20H
                        BYS20I BYS20J BYS20K BYS20L BYS20M BYS20N
                        BYS21B BYS21C BYS21D BYS21E
                        BYS28  BYS27A BYS27B BYS27C
                        BYS62A BYS62H BYWORKSY
                        BYSEX BYRACE_2 BYS15 PUBLIC URBAN RURAL
                        F1SES1R BYTXCTD F1RGP10
                        BYS38C BYS42 BYS43 BYS91
                        BYS24C BYS24D BYS24F;
            MISSING     = ALL (999);
            IDVARIABLE  = ID;
            WEIGHT      = BYEXPWT;
            USEVARIABLS = ID
                        BYS20A BYS20B BYS20E BYS20F BYS20G BYS20H
                        BYS20I BYS20J BYS20K BYS20L BYS20M BYS20N
                        BYS21B BYS21C BYS21D BYS21E
                        BYS28  BYS27A BYS27B BYS27C
                        BYS62A BYS62H BYWORKSY
                        BYSEX BYRACE_2 BYS15 PUBLIC URBAN RURAL
                        F1SES1R BYTXCTD F1RGP10
                        BYS38C BYS42 BYS43 BYS91
                        BYS24C BYS24D BYS24F;
            CLASSES     = c(3); !Three latent classes
            CATEGORICAL =
                        BYS20A BYS20B BYS20E BYS20F BYS20G BYS20H
                        BYS20I BYS20J BYS20K BYS20L BYS20M BYS20N
                        BYS21B BYS21C BYS21D BYS21E
                        BYS28  BYS27A BYS27B BYS27C
                        BYS62A BYS62H BYWORKSY;
ANALYSIS:
            TYPE        = mixture missing;
            PROCESSORS  = 4;
            MITERATION  = 5000;
            STARTS      = 200 20;
            STITERATIONS=100;
            LRTBOOTSTRAP=100;
MODEL:
            %OVERALL%
            c on BYSEX BYRACE_2 BYS15 PUBLIC URBAN RURAL F1SESR;

OUTPUT:     SAMPSTAT STANDRDIZED TECH11;

PLOT:       type = plot3;
            series =    BYS20A BYS20B BYS20E BYS20F BYS20G BYS20H
                        BYS20I BYS20J BYS20K BYS20L BYS20M BYS20N
                        BYS21B BYS21C BYS21D BYS21E
                        BYS28  BYS27A BYS27B BYS27C
                        BYS62A BYS62H BYWORKSY(*);

SAVEDATA:   SAVE=CPROBABILITIES;
            FILE IS CPROBSAV01.DAT;
            FORMAT IS FREE;
            ESTIMATES=MIXESTIMATES01.DAT;
```

Bowers & Sprott (2012) *Why tenth graders fail to finish high school*