The Prediction of Students' Track Appropriateness in School

Students' Ethnicity as a Moderator of the Prediction's Validity

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Abstract—**In Luxembourg and other European countries, school placement decisions made at the end of primary school determine the track a student will follow in secondary school. About one-third of the students in Luxembourg come from immigrant families. Research has shown that this demographical factor influences school placement decisions, as students with an immigration background are more likely to be oriented towards a lower track than are native students (e.g., [1]). It seems reasonable to assume that immigration background may also moderate the predictive validity of school placement decisions. In the present study, we examined whether students' nationality moderates the predictive validity of school placement decisions in Luxembourg. We compared school placement decisions of three age-cohorts of students with the tracks they attended three to five years later. Subgroup analyses revealed that the predictive validity of school placement decisions was actually affected by nationality. Kappa coefficients, expressing the closeness of the relationship between placement decisions and the actual track, were higher for Luxembourgish students than for students of other nationalities. Additionally, multilevel regression analysis showed that Luxembourgish students were more likely to keep on the track than immigrant students.**

Keywords--school placement decisions; predictive validity; students' achievements; students' ethnicity; moderator effect

I. INTRODUCTION

In school systems with hierarchical tracking, common in some European countries like Germany, Austria, Switzerland, and Luxembourg, primary school teachers are required to make decisions by which students are allocated to a certain track of secondary school. In Luxembourg, this decision is taken by a decision council at the end of sixth grade of primary school. The council is composed of the students' primary school teacher and of secondary school teachers, chaired by the local school inspector. Students are oriented to one of three hierarchical tracks that constitute the Luxembourgish secondary school system. These are the *Enseignement Secondaire Classique* (ES; the highest track), the *Enseignement Secondaire Technique* (ST; the middle track), and the *Régime Préparatoire* (RP; the lowest track). Students are generally oriented towards the ES when they have a flawless achievement profile. An achievement profile showing difficulties in one or more subjects generally leads to on orientation towards the ST track, while students with major learning difficulties are oriented towards the RP track. The decision of the council is mandatory. Therefore, it strongly determines the future academic career of each student. According to regulations published by the Luxembourgish Ministry of Education [2], the students' level of achievement in primary school ought to be the main determinant of the tracking decisions made by the council. Indicators of achievement are students' school marks in the main curricular areas (French, German, and Mathematics) as well as scores of standardized scholastic achievement test that are administered in the main curricular areas in sixth grade of primary school.

However, as has been shown in a variety of studies, tracking decisions are not only determined by students' achievements, but are also affected by variables of the students' social background [3-5]. In particular, students' ethnicity is one of the factors that affect teachers' decisions regarding track orientation [1]. In Luxembourg, about one-third of the students have an immigration background. Most of these students come from Portuguese families. Results of the PISA 2006 study [6] showed that in Luxembourg children with immigration backgrounds seem to be disadvantaged with respect to the tracking decisions that were given. For example, only 19 % of the students who have an immigration background attend the highest track, compared to 45 % of the students without immigration background. Recently, [7] could show with a representative sample of Luxembourgish primary school 6th graders that even when achievement variables were controlled, the immigration background of students contributed significantly to teachers' tracking decisions, with immigrant students being more likely to be oriented towards a lower track than Luxembourgish students.

Tracking needs justification. This is apparently true because problems may arise when students are assigned to a track they (or their parents) are not comfortable with. Justification of tracking is achieved by relating actual achievements of the students in secondary school to the initial assignment of the students to a certain track. A track is usually considered to be

the right choice if the student initially assigned to that track has remained there and exhibits sufficient achievements. Relating actual achievement of a student to the tracking decision that preceded his or her assignment to a school track refers to the concept of predictive validity. Predictive validity is part of the whole concept of validity which is an overall judgment of the degree to which empirical evidence and theoretical rationales support the adequacy and appropriateness of interpretations and actions on the basis of test scores and other modes of assessment [8].

The scientific literature provides a few reports of examinations that were done on the predictive validity of school placement decisions within hierarchical school systems. Students who attended a recommended school track were more likely to stay on this track than students who chose the same track without corresponding recommendation [9-12]. However, even of those students who were taught on non-recommended school tracks a remarkable percentage reached sufficient achievement.

As school placement decisions have been shown to be affected by students' ethnicity, ethnicity might even impair the correctness of these decisions. More specifically, since immigrant students in Luxembourg are more likely to be oriented towards a lower track than native students, even if their achievements in primary school are equal, it seems reasonable to assume that immigrant students accordingly are more likely to start secondary school on the "wrong" track than their native peers. We therefore hypothesized that the predictive validity of school placement decisions for immigrant students is lower compared to Luxemburgish students. Consequently, in order to adjust an initial misjudgement in placement, students with an immigration background might be found to change tracks more frequently than native students. Yet, differences in the frequency of track changes between students of different ethnicities might be due to the track to which the students were oriented to for secondary school rather than due to ethnicity. For example, students attending lower tracks (e. g., immigrant students) might be *more prone* to change towards a higher track than students attending higher tracks (e. g., native students). Therefore, we additionally wanted to know whether the track on which the students started secondary school (which was the same track to which they were oriented) also affected the frequency of track changes, independent of ethnicity. Moreover, as track changes often are preceded by extraordinary achievements in school (either below or above average), we examined whether school marks, obtained in the first year of secondary school, did also contribute to the frequency of track changes. Finally, since we obtained data from three age-cohorts of students, we wanted to know whether students of different age-cohorts changed tracks with different frequencies.

II. METHOD

A. Participants

Data from all students of three age-cohorts were recorded by the Luxemburgish Ministry of Education. The Ministry annually records data from all students of the Luxemburgish Grand-Duchy in order to keep track of the career of the students. The data entailed the school placement decisions the students got, and information about the track the students attended in secondary school. After anonymisation, the data were made accessible to the University of Luxembourg.

Since school placement decisions are binding, students have to attend the track to which they were oriented at least for the first year of secondary school. However, parents can make a special request to the Ministry if they want their child to attend a different track. As most of these requests are not approved, the percentage of students not attending the recommended track is rather small (< 3 %). Moreover, students attending a non-recommended track will automatically lower the predictive validity of the placement decisions, not because the tracking decision was poor but rather because they voluntarily chose a different track. For instance, suppose that a number of students were recommended for the highest track, but actually chose a lower track. If these students were successful in their tracks and kept the track throughout secondary school, this would implicate that the teachers' tracking decisions might have been erroneous. However, keeping the track could also mean that these students (or their parents) volunteered for following a lower track in order to obtain vocational qualifications. In other words, their choice in favour of a lower track as well as their staying there merely reflects their preferred school career and not the accuracy of the tracking decision. Therefore, data of these students were disregarded for further analyses.

In the present study, we used data from three age-cohorts of students. Student numbers in the cohorts at the beginning of 7th grade varied between 4,148 and 4,205, resulting in a total of 12,525 students. 68.2 % of all participating students were Luxemburgish, 16.9 % were Portuguese and 14.9 % had other national backgrounds. Of all students, 50.7 % were girls and 49.3 % were boys. The number of students decreased slightly with increasing grade because some students (or their parents, respectively) moved away from Luxembourg to other countries and their data was no longer being recorded.

B. Variables

The following variables were used for the analyses.

School placement decisions. Each student at the end of 6th grade in primary school receives a school placement decision which orients the student to one of the tracks of secondary school. As the secondary school is composed of three tracks, the corresponding school placement decisions are tripartite as well. The Luxemburgish school system differentiates between placement decisions in favor of the highest track, the middle track, or the lowest track. In our entire sample, 38.7 % of the students were oriented to the highest track, 54.4 % were oriented to the middle track, and the remaining 6.9 % attended the lowest track.

Age-cohort. The data of students that were part of our analyses were drawn from three age-cohorts of students. The age-cohorts were indicated by the year the students received their school placement decisions (which happened for all students at the end of primary School in 6th grade). The school years were 2001/2002, 2002/2003, and 2003/2004. The

numbers of students of each age-cohort differed minimally ($n_{2001/2002}$ = 4,148, $n_{2002/2003}$ = 4,172, $n_{2003/2004}$ = 4,205).

Student's ethnicity. The students originated from different ethnicities from all over the world. The most prominent one was the Luxembourgish ethnicity, followed by the Portuguese. The remaining ethnicities were more or less equally frequent within the population of students so that we merged these students to a single group. Hence, ethnicity was treated in our study as a nominal variable with three values (Luxembourgish, Portuguese, and other). The vast majority of students with an immigration background were not Luxembourgish citizens, but were citizens of other nations [13].

School track after three and five years of schooling in secondary school. We were provided with records of the school track each student attended three and five years after entering secondary school.

School marks in 7th grade. Additionally, we were provided with the average school marks the students earned at the end of 7th grade, which was the end of the first year of secondary school. In Luxembourg, school marks were given as integers, ranging from 0 to 60, with larger integers meaning higher achievements. School marks smaller than 30 indicate insufficient achievements. The mean of the school marks of the entire sample was 40.08 (SD = 12.74).

C. Procedure

With this study we aimed at testing whether students' immigration background was a moderator of the predictive validity of tracking decisions. Therefore, we split the sample into subgroups according to students' ethnicity (Luxembourgish, Portuguese, and other). After sub-grouping the sample, predictive validity of the tracking decisions was analysed for each subgroup separately. To provide information about the level of agreement between placement decisions and tracks, Cohen's kappa [14] was used to give an estimate of predictive validity. The tripartite secondary school becomes a dual-track system at the beginning of 10th grade, consisting of the highest and the middle track[1]. That is, all students in the lowest track either join one of the higher tracks or leave school (as compulsory schooling ends after 9th grade). Therefore, we estimated predictive validity of the school placement decisions after three years of schooling by relating the three-level school placement decisions to the three tracks that constituted the Luxembourgish secondary school until the end of 9th grade. However, when validating the school placement decisions after five years of schooling in secondary school (which was in most cases the 11th grade), we were faced with the problem that the three-level school placement decisions had to be related to only two tracks that the students were attending. To make an estimate of the level of agreement between school placement decisions and school tracks possible, we decided to dichotomize the school placement decisions, which yielded one level indicating the decision for being taught on the highest

track and another level indicating the preference for being taught on one of the lower tracks. Additionally, we analysed the effects of students' ethnicity on the predictive validity of school placement decisions by multilevel logistic regression analysis [15]. In this analysis, the binary dependent variable was the students' achievements in school. Achievements were measured by track-keeping within a period of five years (from the beginning to the fifth year of secondary school), with "keeping the track" versus "leaving the track" as values. Predictors were the students' ethnicities, the school marks obtained in their first year of secondary school and the school placement decisions. Since there were three values of ethnicity (Luxembourgish, Portuguese, and other), we coded ethnicity by means of two dummy variables, with Luxemburgish students as reference values. Regarding the school placement decision, we referred to the dichotomized version we introduced above.

We examined students' careers for three different age-cohorts. In order to control for possible effects of the age-cohorts on the likelihood of track changes, we used the variable age-cohort as a Level-2 predictor in multilevel regression analysis. In unilevel regression analysis, variation of the criterion is traced back to variation of each predictor, and combinations of them, being inserted into the regression equation. For example, in case of a two-predictor model, variation of the criterion may be explained by either predictor, or by their mutual covariance. In multilevel regression, researchers make use of the fact that often individuals, of whom a certain behavior serves as a criterion in regression analysis, are embedded within larger entities. For example, when analyzing students' behavior (like track changes), we shall be aware of the fact that students are embedded within classes, classes within schools, etc. These higher levels might also affect variation of the criterion. Hence, adding a higher level to the regression model may help identify supplementary effects, or even mutual interactions between the levels included. Since an age-cohort can be considered as a level of observation that is superior to the level of an individual, and therefore captures all individuals of our study, we decided to use it as Level 2 in our regression analysis.

III. RESULTS

A. Subgroup Analyses

Table 1 shows the distribution of students from each ethnicity and each age-cohort according to the tracks in their 3rd year in secondary school and the school placement decisions they obtained in primary school. As Table 1 shows, most students kept the track to which they were initially assigned. However, from those students who left their track, the direction of track change was dependent on students' ethnicity. Whereas Luxembourgish students more frequently switched to a lower track than to a higher track, the reverse was the case with immigrant students. We calculated the agreement coefficient Kappa for each subgroup separately, which are also displayed in Table 1.

The Kappa coefficient was on average highest for Luxembourgish students (mean κ = .88), whereas the co-efficient for Portuguese students was lowest (mean κ = .70) and the coefficient for students from other ethnicities was in-

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[1]   Actually, the middle track is comprised of different training courses (resembling specific vocational-training courses) of which each may lead to a specific degree. Since the tracking decisions do not predict (nor imply) a specific course in secondary school, we decided to consider the middle track as a uniform track.

between (mean κ = .82). The test of significance for the diff-erences between two independent κ's within each age-cohort was obtained according to [14]. Even after conservative Bonferroni correction for multiple comparisons, pairwise com-parisons revealed statistically significant differences between a□□□□□□□□□□of κ, except for the third age-cohort where the difference between the Luxembourgish students and the students from other ethnicities ("other") was not significant.

TABLE 1. NUMBER OF STUDENTS IN THEIR THIRD YEAR OF SECONDARY SCHOOL, DEPENDING ON THE AGE-COHORT, STUDENTS' ETHNICITY, THE TRACK AND THE SCHOOL PLACEMENT DECISION.

	Age-Cohort 2001/2002										
	Students' Ethnicity										
	Luxembourgish				Portuguese				Other		
	Track 3rd Year				Track 3rd Year				Track 3rd Year		
Track. Decis.	ES	ST	RP	Track. Decis.	ES	ST	RP	Track. Decis.	ES	ST	RP
ES	1245	73	0	ES	79	8	0	ES	171	13	0
ST	31	1320	44	ST	3	416	13	ST	9	306	12
RP	0	53	84	RP	0	47	39	RP	0	26	22
κ	.87 (.01)			κ	.72 (.03)			κ	.80 (.02)		
	Age-Cohort 2002/2003										
	ES	ST	RP		ES	ST	RP		ES	ST	RP
ES	1199	66	0	ES	92	21	0	ES	195	17	0
ST	16	1334	37	ST	10	451	26	ST	5	330	16
RP	0	48	61	RP	0	45	39	RP	0	24	16
κ	.89 (.01)			κ	.65 (.03)			κ	.80 (.02)		
	Age-Cohort 2003/2004										
	ES	ST	RP		ES	ST	RP		ES	ST	RP
ES	1206	55	0	ES	104	10	0	ES	194	9	0
ST	40	1235	25	ST	5	496	12	ST	4	342	5
RP	0	45	63	RP	0	57	39	RP	0	24	26
κ	.88 (.01)			κ	.72 (.03)			κ	.86 (.02)		

Note. Kappa (κ) is the estimate of predictive validity of the tracking decisions. Numbers within parentheses indicate standard errors. ES—Enseignement Secondaire Classique (highest track); ST—Enseignement Secondaire Technique (middle track); RP—Régime Préparatoire (lowest track).

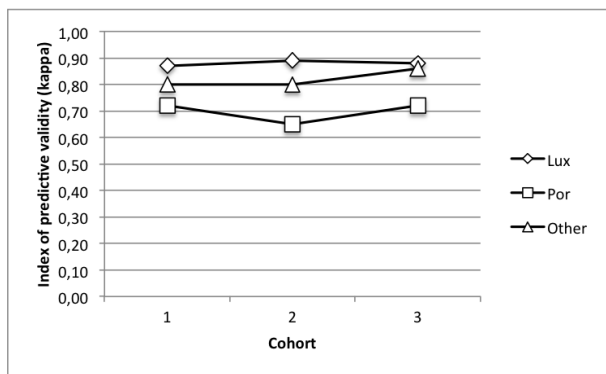In Fig. 1, the values of κ are displayed at a glance.

Figure 1. Predictive validity of tracking decisions, obtained after three years in secondary school. Predictive validity is measured by Cohen's Kappa, and is displayed depending on age-cohort and students' ethnicity.

In addition, we examined the validity of school placement decisions obtained after five years secondary school education. We expected that the index of predictive validity would be lower when measured after five years than after three years of education in secondary school. Table 2 depicts the distribution of students from each ethnicity and each age-cohort according to the tracks in their 5th year of secondary school and the tracking decisions they obtained in primary school. Due to the merger of the tracks in secondary school, we also merged the school placement decisions into two categories, which were a decision favouring the highest track (ES) and a decision favouring one of the lower tracks (ST or RP). That is, decisions were regarded as correct (and thus valid) if the ES track was preceded by a decision in favour of the ES track or if the ST track was preceded by a decision in favour of either the ST track or the RP track.

TABLE 2. NUMBER OF STUDENTS IN THEIR FIFTH YEAR OF SECONDARY SCHOOL, DEPENDING ON THE AGE-COHORT, STUDENTS' ETHNICITY, THE TRACK AND THE SCHOOL PLACEMENT DECISION.

	Age-Cohort 2001/2002							
	Students' Ethnicity							
	Luxembourgish			Portuguese			Other	
	Track 5th Year			Track 5th Year			Track 5th Year	
Track. Decis.	ES	ST	Track. Decis.	ES	ST	Track. Decis.	ES	ST
ES	1152	139	ES	74	12	ES	144	21
RP/ST	34	1331	RP/ST	6	450	RP/ST	10	309
κ	.87 (.01)		κ	.87 (.03)		κ	.86 (.03)	
	Age-Cohort 2002/2003							
Track. Decis.	ES	ST	Track. Decis.	ES	ST	Track. Decis.	ES	ST
ES	1096	143	ES	80	29	ES	166	33
RP/ST	18	1325	RP/ST	12	494	RP/ST	6	323
κ	.88 (.01)		κ	.76 (.04)		κ	.84 (.03)	
	Age-Cohort 2003/2004							
Track. Decis.	ES	ST	Track. Decis.	ES	ST	Track. Decis.	ES	ST
ES	1096	145	ES	91	20	ES	173	19
RP/ST	45	1212	RP/ST	6	532	RP/ST	7	345
κ	.85 (.01)		κ	.85 (.03)		κ	.89 (.02)	

Note. Kappa (κ) is the estimate of predictive validity of the tracking decisions. Numbers within parentheses indicate standard errors. ES—Enseignement Secondaire Classique (highest track); ST—Enseignement Secondaire Technique (middle track); RP—Régime Préparatoire (lowest track).

Notably, the level of predictive validity indicating the agreement between school placement decisions and tracks in the 5th year in secondary school did not decrease to a substantial degree, compared to the validity coefficients with regard to the 3rd year in secondary school. Instead, with respect to students from different ethnicities ("other"), the coefficients even slightly increased.

Again, kappa was on average highest for Luxembourgish students, followed by students of different ethnicities and then by Portuguese students. However, the differences between Kappas were rather marginal. The only significant difference was between Portuguese and Luxembourgish students in age-cohort 2002/2003 ($p = .004$).

Moreover, the age-cohorts from which the data of students were derived seemed to affect the level of agreement between school placement decisions and the actual tracks. The age-cohort 2002/2003 exhibited lower values of kappa than the other age-cohorts. This was especially the case for the Portuguese students, a tendency that was also obtained from the three-year validation. However, after correction for multiple comparisons, the differences between Kappas of

different age-cohorts remained below the significance level (α = .05/3 = .017).

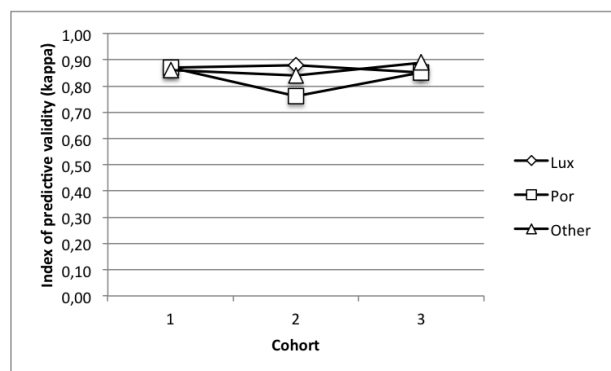Fig. 2 shows the values of κ.

Figure 2. Predictive validity of tracking decisions, obtained after five years in secondary school. Predictive validity is measured by Cohen's Kappa, and is displayed depending on age-cohort and students' ethnicity.

B. Multilevel logistic regression analysis

We used a hierarchical model for regression analysis, with students' achievements as criterion, dichotomized as "keeping the track" versus "leaving the track". In this regression model, ethnicity, school placement decisions, and school marks were used as Level-1 predictors, and the age-cohort of the students was included into the model as Level-2 predictor. Since age-cohort was a nominal variable, in order to make its quantification meaningful, we created two dummy variables. The first dummy variable represented the age-cohort 2002/2003, the second one the age-cohort 2003/2004. The reference category was the age-cohort 2001/2002. Table 3 depicts the results of the regression analysis.

TABLE 3. RESULTS OF THE REGRESSION ANALYSIS.

Predictors	Odds ratio	p-value
Level 2		
Age-cohort: 2002/2003	0.99	.97
Age-cohort: 2003/2004	1.52	< .001
Intercept	2.99	< .001
Level 1		
Ethnicity: Portugal	1.45	< .001
Ethnicity: Other	1.13	.199
School placement Decision (highest track)	1.08	.312
School marks	.92	< .001
Deviance	28040	

Note. The larger the odds ratio was, the more likely was a student to leave a track.

As Table 3 shows, significant effects were obtained from the predictors "age-cohort", "ethnicity", and "school marks". The odds ratio related to age-cohort means that there was an effect of age-cohort, indicating that the frequency of track changes differed significantly between students of different age-cohorts. More precisely, the likelihood for track changes increased for students of age-cohort 2003/2004 relative to students of the other age-cohorts.

As hypothesized, ethnicity did also matter with respect to the likelihood of track changes. Portuguese students were more likely to change a track than were native students or students from other ethnicities. Moreover, school marks contributed significantly to the likelihood of changing a track, with higher school marks (representing higher achievements) increasing the likelihood for keeping on a track. However, the school placement decisions did not affect school achievements to a significant degree.

IV. DISCUSSION

Results from the present study show that the predictive validity of school placement decisions in Luxembourg was affected by students' ethnicity. Predictive validity was higher if students were Luxembourgish than if students showed an immigration background. These differences in predictive validity of school placement decisions indicate that immigrant students were more often than native students oriented to a track that did not fit their capabilities and needs. Moreover, immigrant students switched more frequently to a higher track than to a lower track, compared to native students who more frequently were downgraded than upgraded.

In addition, multilevel regression analysis confirmed that students' likelihood for keeping a chosen track was lowered if the students had an immigration background. This was even the case if school placement decisions were controlled for. That is, ethnicity played a role regarding staying on or leaving a track even when native and immigrant students were on the same track.

Furthermore, and rather unexpectedly, the age-cohort from which the students came affected the likelihood of track changes and hence the predictive validity of school placement decisions. There seems to be no obvious reason for this effect, but it can be assumed that within different cohorts, different teachers were in charge of making school placement decisions, and different teachers were responsible for deciding whether a student held the track or was supposed to leave it. Since the effect of the age-cohort was independent of the school marks the students obtained, and because the change of tracks is primarily due to school marks, it seems likely that differences between age-cohorts are caused by the teachers' different tendencies to assign students to a certain track.

To conclude, teachers' tracking decisions can be seen as a forecast of students' achievements in secondary school. The predictive validity of school placement decisions can be regarded as a measure of the accuracy of this forecast. However, as this study has shown, the forecasts' accuracy is significantly diminished by students' ethnicity, reflecting a tendency of teachers to be too pessimistic about achievements of students from immigration backgrounds.

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