The Journey to School as an Influencing Factor on School Grades at Vocational Colleges

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This study aims to investigate the relationship between travelling to school and the academic performance of vocational school students. In doing so, the study draws on teaching-learning theories as well as previous studies on travel to school factors. The results of the study show that an active journey to school can improve well-being, which in turn has a positive effect on grades. However, the data did not confirm that an active journey to school leads directly to better grades or that longer journeys to school have a negative impact on grades. These results emphasise the role of the journey to school for the well-being of pupils. It can therefore be assumed that travelling to school as part of students' daily lives plays an important role in their emotional well-being and should therefore be considered in a broader context when it comes to creating a conducive educational environment.

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1 Research question, state of research and research gap

Teaching-learning theories form the basis for students' learning success. According to behaviourist learning theories, learning consists of the formation of associations between sensory impressions and impulses for action and manifests itself in changes in behaviour. Constructivist theories of learning recognise learning as the active construction of knowledge. Every cognitive activity must be seen in a spatial and social context (Fürstenau, 2019, p. 7). Several influencing factors have an effect on cognitive performance. In the studies by Martínez-Gómez et al. (2011, p. 303) and Rummer and Herzmann (2014, p. 90), correlations were established between individual factors relating to the journey to school, such as time or the organisation of the journey (active or passive). A bundling of these influencing factors with a final consideration based on the pupils' performance has not yet been conceptualised.

The way of travelling to school has various effects on the students. Klocke et al. (2017, p. 7) show that a journey to school that takes longer than 45 minutes can lead to concentration problems. There is a correlation between the length of the journey to school and irritability as well as concentration problems. Rummer and Herzmann (2014, p. 90) found evidence that a long, passive journey to school has a negative impact on pupils' performance. This research result was attempted to be explained by the correlation between the lack of homework time and the long journey to school. However, this assumption could not be confirmed. Instead, Rummer and Herzmann (2014, p. 90f) assumed an inverse causal relationship. The students tried to compensate for the negative effects of the longer journey to school by spending more time on homework. Stöhr et al. (2019, p. 5) also show that travelling long distances every day has a negative impact on health, performance, satisfaction and stress levels.

Stöhr et al. (2019, p. 6) point to the positive influence of active travel to school. García-Hermoso et al. (2017, p. 1) come to the conclusion that actively walking 30 to 60 minutes to school can have a positive influence on grades in maths and language. Rummer and Herzmann (2014, p. 91) show a contrasting result. They found no correlation between an actively organised journey to school and school grades.

There are diverging results in gender-specific studies of the journey to school. According to Martínez-Gómez et al. (2011, p. 303), a correlation between an actively organised journey to school and higher performance at school could be demonstrated in pupils. García-Hermoso et al. (2017, p. 1), on the other hand, found no significant correlation between gender, the way to school and the grade. Furthermore, it can be noted that most studies look at female pupils between the ages of 6 and 13. There is also sufficient data on the commuting of adults to work. Grobe (2012, p. 8) found that commuting to work can have a significant impact on health. For pupils from middle school to working life, there are no target-oriented research results to date. For this reason, this study will look at the journey to school for students at vocational schools and how the journey to school is organised. Specifically, it is investigated whether a significant correlation can be established between the organisation of the journey to school and the school grade. In this context, further stress dimensions in the organisation of the journey to school must be examined. The time aspect is only one dimension here; the question of the mode of transport and the associated perception of stress will also be the subject of this research project with regard to their effects on the school grade (Sixt et al., 2018, p. 134). This study thus examines the tension between actively and passively organised journeys to school in connection with the grades achieved at vocational colleges.

2 Generation of hypotheses

Martínez-Gómez et al. (2011, p. 302) show that active travel to school has a positive effect on school grades. Breithecker and Dordel (2003, p. 13f) also confirm this correlation. The study shows that exercise has a positive influence on performance and concentrated learning. Pupils with a more pronounced movement behaviour during breaks and lessons make fewer mistakes in performance assessments than pupils who do not move. Boos (2010, p. 101) explains the link between movement and memory in her study as follows: "Movement can therefore be a physiological stimulus for the hippocampus, which then switches "on receive". It strengthens thinking and helps the brain to grow in volume when it threatens to shrink measurably from the 3rd decade of life." (Boos, 2010, p. 101).

Hypothesis 1: Pupils who actively organise their journey to school have better grades.

Klocke (2017) comes to the conclusion that there is a demonstrable link between the length of the journey to school and concentration problems as well as irritability. He cites the lack of sleep caused by the longer journey to school as the reason for this. Pupils with a long journey to school get up on average around 30 minutes earlier than pupils with a short journey to school. Klocke (2017, p. 6) was able to prove that a longer journey to school causes more stress for pupils. It can be assumed that the results obtained with seventh-grade students also apply to older students. Pfaff (2014, p. 116) investigated the psychological effects of commuting in professional life and came to the conclusion that the lack of free time can even lead to psychosomatic illnesses. This finding can also be applied to students, as they lack the time for leisure activities and thus the balance to school due to the longer journey to school. The lack of free time increases the occurrence of psychosomatic illnesses and demonstrably reduces well-being (Drummer, 2021, p. 225). Due to the poorer well-being, the students' performance is lower. This dissatisfaction and the resulting lower performance has a negative impact on school grades, as these students make more mistakes in performance assessments. The higher frequency of errors ultimately leads to a lower grade in the performance assessment and, accordingly, to a lower final grade (Breithecker & Dordel, 2003, p. 10). Hypotheses 2 and 3 can be generated from these findings. They take into account both the duration of the journey to school and well-being in connection with school performance.

Hypothesis 2: A journey to school longer than 30 minutes has a negative effect on the school grade.

Hypothesis 3: An active journey to school mediates well-being, which has a positive effect on the grade.

3 Research design

A quantitative survey method was chosen to answer the formulated research questions. In order to conduct a quantitative examination of the relationship between the students' perception of stress and their school grades, an anonymous online survey was conducted in the vocational schools at the beginning of the practical semester from 12 March 2023 to 14 June 2023. The vocational schools visited by the students during the practical semester serve as the basis for the survey.

The survey refers to students from seven vocational schools with different educational backgrounds.

The questionnaire used contains both biographical questions and questions about the students' well-being on the way to school, which are examined by observing the dependent, independent and mediator variables. In this empirical study, the effects of the mode of transport and the duration of the journey to school on the school grade are analysed.

The first research question of this study focuses on identifying the most frequently used mode of transport for travelling to school among students. For this purpose, the results are standardised using a single selection. To record the means of transport, the results of the questionnaire are divided into the three subgroups *active*, *active (motorised)* and *passive* using a categorisation method. The active category includes walking and cycling. The active (motorised) category includes active driving a car, motorbike/scooter or e-scooter. The passive category includes travelling to school by car as a passenger or using the bus or train.

The use of an active or passive mode of transport and the *duration of the journey to school* are defined as independent variables, while the *school grade* is considered a dependent variable. In order to analyse the relationship between these variables, *well-being* is selected as a mediator variable. This makes it possible to investigate the mechanisms that influence the relationship between the mode of transport and the school grade and thus to gain a deeper understanding of the relationship.

The second research question in this study aims to record the time spent travelling to school. For this purpose, a question with eight possible answers is used, which relate to different times of the journey to school and range from zero to over 60 minutes. Subsequently, the stress level of the test subjects in connection with their journey to school is recorded. A six-point Likert scale is used (Kumar, 2011, p. 170). The data was collected using a slider. Due to the fact that the use of a seven-point Likert scale offers the possibility of frequent selection of the mean value, such a scale is not used in this study.

The next question refers to the determination of the modal value of the report card grades of each individual student. For this purpose, a six-point scale is used as an evaluation scale and the data is recorded using a slider. This allows the frequency of occurrence of certain grade values to be recorded. The mean of grades is 2.49 (on a scale from 1 – very good to 6 – unsatisfactory) and is normal distributed.

At the end of the survey, the respondents' biographical data is collected, focussing on gender and age. The gender information is collected by using a single selection (54% female and 46% male students). It is then necessary for the students to enter their age in a text field. The mean age of the participants is 21,65 years.

To check whether the students have answered the questions in the questionnaire truthfully, a control question is implemented which asks the students to indicate whether they are students at a vocational school. The possible answers are either yes or no. In cases where significant deviations are found with regard to the individual processing time in relation to the average total processing time, these data points are removed from the raw data set.

4 Results

4.1 Evaluation procedure

To analyse the questionnaire, the data from the Sociosurvey online survey tool is first imported into the IBM SPSS Statistics program. The next step is the necessary data cleansing and preparation so that the variables can be used for further analyses. This involves, for example, deleting variables that are not relevant for further analyses and missing entries, as well as adjusting the scale levels. Based on the control question, seven items are considered unusable. This includes an adjustment rate of approximately 1.8%. Furthermore, the students in the survey indicated their main mode of transport using a single choice. The first step here is to cluster the information into active, active (motorised) and passive and recode it accordingly. This allows the sample to be divided into three groups, which are then compared with each other. The analysis is first divided into a descriptive and then an inferential statistical procedure. The descriptive analysis includes demographic data such as gender and age, as well as information on the duration and type of travel on the way

to school. In the demographic data, both gender and age are unremarkable. However, the mode of transport is very unevenly distributed.

Table 1: Frequency of the individual means of transport

Mode of Transport				
Valid	Frequency	Percent	Valid Percent	Cumulative Percent
On foot	65	12.2%	12.2%	12.2%
Bicycle	11	2.1%	2.1%	14.3%
Motorcycle / Scooter (E-Scooter, etc.)	12	2.3%	2.3%	16.5%
Car (self-driving)	189	35.5%	35.5%	52.1%
Car (driven by parents, etc.)	33	6.2%	6.2%	58.3%
Bus / Train	222	41.7%	41.7%	100.0%
Total	532	100.0%	100.0%	100.0%

Source: Own

Among other things, boxplots are created. However, these boxplots do not show any significant anomalies.

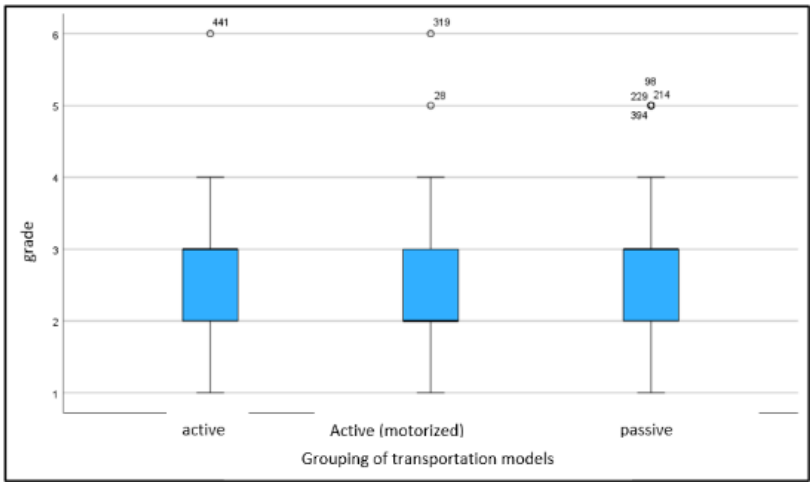

Figure 1: Boxplots of the school grade depending on the duration of the journey to school

Source: Own

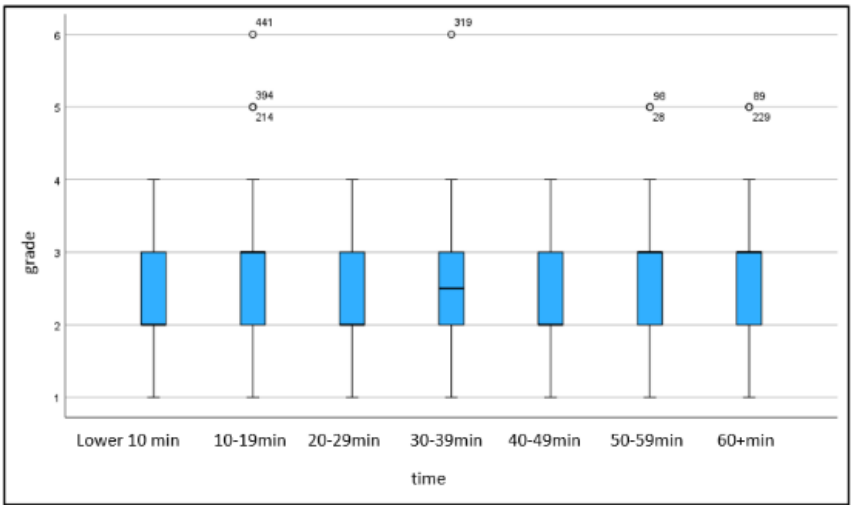

Figure 2: Boxplots of the school grade depending on the means of transport
Source: Own

Furthermore, the assumption of normal distribution is tested. Only the school grades are normally distributed. Therefore, the T-test could not be used and an ANOVA (Analysis Of Variance) was used instead. The mediation analysis is then carried out using Hayes' process. For the third hypothesis, the *mode of transport* is assumed to be the predictor (independent variable) and the *school grades* as the criterion (dependent variable). The mediator variable is *well-being*. Since the survey asks about the students' perception of stress, the values must be recoded so that the highest value of stress perception is now the lowest value of well-being. This is also carried out analogously for all other values. The indirect as well as the direct effects of the independent variable *mode of transport* on the dependent variable *school grades* are thus analysed, taking into account the recoded mediator variable *well-being*.

4.2 Results for hypothesis 1

For hypothesis 1, the means of transport serves as a nominally scaled, independent variable with three characteristics or groups. The dependent variable, school grade, is ordinally scaled. The first hypothesis belongs to the family of difference hypotheses, as we are interested in the differences between the three groups of the predictor variable. Variance analysis is used as the method of statistical evaluation,

as the differences between more than two groups are analysed. A prerequisite for the analysis of variance is variance homogeneity, which is tested using a Levene test. The null hypothesis of the Levene test is equality of variance, and since the p-value p=0.141 is above the significance level of 5%, the null hypothesis is retained and homogeneity of variance is assumed. After performing ANOVA, the paired comparisons between the groups are performed under the Bonferroni correction.

Table 2: Significance tests (ANOVA) of the school grade depending on the means of transport

Dependent variable: School grade							
	(I) Transport grouping	(J) Transport grouping	Mean value difference	Std-error	Sig.	Confidence Interval	
						Lower limit	Upper limit
Bonferroni	**active**	active (motorized)	,241	,118	,125	-,04	,53
		passive	-,171	,115	,413	-,45	,11
	active (motorized)	active	-,241	,118	,125	-,53	,04
		passive	-,412*	,083	<,001	-,61	-,21
	passive	active	,171	,115	,413	-,11	,45
		active (motorized)	,412*	,083	<,001	,21	,61
Tamhane	**active**	active (motorized)	,241	,125	,156	-,06	,54
		passive	-,171	,123	,427	-,47	,13
	active (motorized)	active	-,241	,125	,156	-,54	,06
		passive	-,412*	,081	<,001	-,61	-,22
	passive	active	,171	,123	,427	-,1	,47
		active (motorized)	,412*	,081	<,001	,22	,61

No significant differences were found here, except between the "active (motorised)" and "passive" groups. Hypothesis 1 is therefore not confirmed.

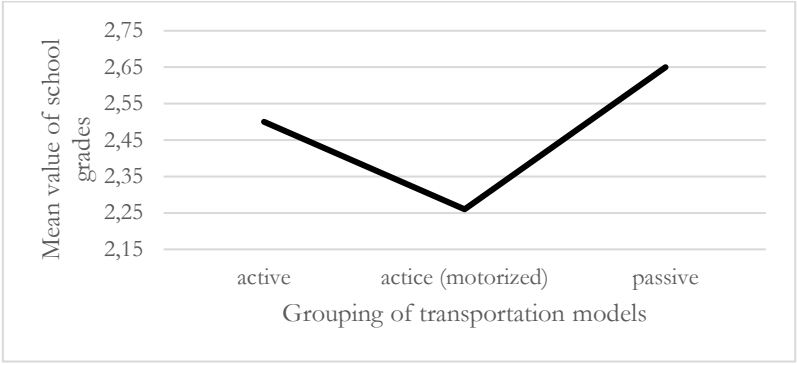

Figure 3: Mean values of the school grades depending on the type of means of transport
Source: Own

4.3 Results for hypothesis 2

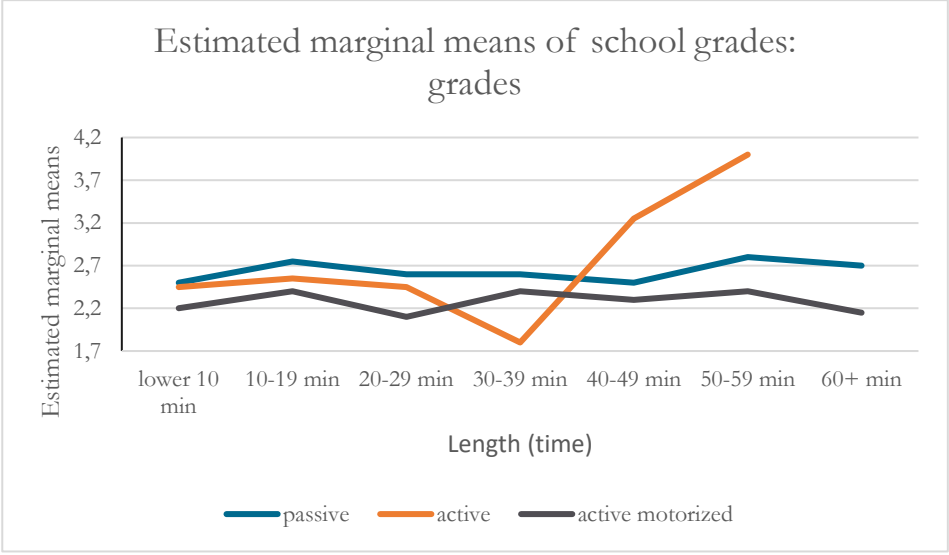

Figure 4: School grades depending on time and means of transport
Source: Own

Here, the independent variable duration of the journey to school is ordinal-scaled, while the dependent variable school grades is interval-scaled. As with the first hypothesis, this is a difference hypothesis, which is analysed using ANOVA. The Levene test is not significant in this case ($p=0.767$), so that equality of variance is

assumed. After performing the analysis of variance using the T-test, the paired comparisons are made using the Bonferroni correction. The corresponding p-values are equal to 1 everywhere, i.e. perfectly non-significant. This means that the null hypothesis cannot be rejected and no significant differences can be detected.

Hypothesis 2 is therefore not accepted and the results cannot be transferred to the population.

4.4 Results for hypothesis 3

In this hypothesis, the dependent metric variable is school grade. As in the first hypothesis, the primary independent variable means of transport is no-minimum scaled. The variable well-being acts as a mediator here. This variable is Likert-scaled with six levels and thus ordinal-scaled, which can also be regarded as quasi-metric for the purposes of the analysis (Kronthaler, 2022, p. 19). Mediated regression is selected as the method of analysis here in order to be able to measure and evaluate direct and indirect effects. Such a mediation analysis makes it possible to check whether the type of mode of transport predicts the trend in school grades and whether the direct path is mediated by well-being. A direct effect is a direct causality between the dependent and independent variable. An indirect effect is the effect that an independent variable has on a mediator, which in turn has an effect on the dependent variable. The following values were determined as part of the inferential statistical analysis:

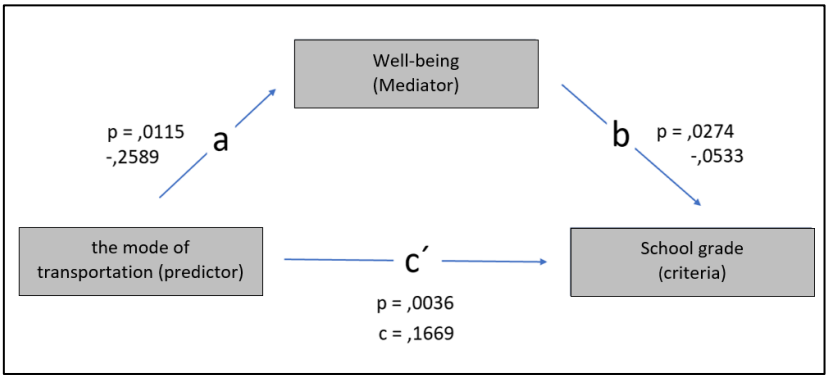

Figure 5: Significance levels and coefficients of mediation

Source: Own

All three paths are significant with a probability of error of less than 5%. There is a significant negative correlation between the independent variable of means of transport and well-being. The same applies to the effect of well-being on the school grade. There is a significant positive correlation between the independent variable means of transport and the school grade. The indirect effect via the path a-b is estimated as follows: b= 0.0138. The associated 95% confidence interval has the following limits: [0,006; 0,0328]. Since 0 is not included in the confidence interval, the results are significant. It can be stated that the relationship between the type of mode of transport and the tendency of school grades is partially mediated by well-being. Hypothesis 3 is therefore confirmed.

5 Conclusion, limitations and perspective

5.1 Conclusion

The empirical study "The journey to school as an influencing factor on school grades at vocational colleges" provides a nuanced picture of the connection between the journey to school and the school grades of students at vocational schools. The first hypothesis, which thematised the influence of the means of transport on school grades, is not confirmed by the research results. An actively organised journey to school therefore has no significant impact on students' academic performance. However, the second hypothesis, which assumed a negative correlation between journey time to school of over 30 minutes and school grades, was also not confirmed by the data collected. The third and final hypothesis, which investigated the indirect influence of an active journey to school on school grades through the promotion of well-being, showed positive results, so that the hypothesis could be confirmed.

To summarise, the study reflects the complexity of the topic. It shows that the journey to school, although it does not appear to have a direct influence on school grades in the survey, is nevertheless an important factor for mental health. The journey to the educational institution is an elementary part of the students' daily lives and indirectly influences their eudaemonia. These findings encourage us to look at the journey to school in a broader context and to recognise the role of the journey to school in creating a conducive educational environment.

5.2 Limitations

School grades are influenced by many different factors, such as motivation, self-efficacy, prior knowledge, parents' level of education and cognitive abilities. However, the interactions and dependencies of these factors with the organisation of the journey to school would exceed the scope of this study. There is also a regional limitation, as the survey is strongly related to the city of Aachen and the surrounding catchment area. The possibilities for reaching schools are specific to the city region, meaning that the findings can only be transferred to a nationwide level to a limited extent. The studies used to generate the hypotheses analysed various target groups and influencing factors. Different study designs, items and scales were used for this purpose. The present study faced the challenge of analysing the target group of students at vocational colleges. Learners at vocational schools are characterised by a wide range of demographic features and differ greatly in terms of their age, life situation or school-leaving qualifications. Conclusions that could be derived from other studies may not be causally transferable to the target group analysed.

Another problem is the sample size of 550 participants, which must be considered a non-representative number of students. Furthermore, it must be noted that the survey had to be carried out as a very rough estimate on the part of the school grades, as the survey took place at a time when the report card grades were already in the distant past. This means that the survey may be prone to errors. In addition, the school grades were given by the pupils themselves and were therefore not subject to any checks. The specific question of the means of transport should also be considered in this context, as in retrospect categories in the area of transport such as the bicycle receive very little attention in relation to vocational schools. Whether this is related to the time of year in which the survey was conducted could not be analysed at this point. The control question was already problematic during the survey, as some students at the full-time school were of the opinion that they were not part of a vocational school, which further reduced the size of the sample.

5.3 Perspective

The organisation of the journey to school and the associated factors influencing pupils' performance were investigated by Rummer and Herzmann (2014), Martínez-Gómez et al. (2011), Stöhr et al. (2019) and in the present study. A common,

dominant factor could not be consistently identified in all studies. Further investigations are needed to exclude demographic and socio-cultural confounding variables. Many studies are limited to an age-specific test group. Differences in school travel behaviour and the effects on performance must be determined across all age groups in order to obtain meaningful results.

In view of the available research results, there are several practical conclusions for teachers in the context of teaching-learning theories. In particular, the realisation that the type and route to school can have a demonstrable influence on academic performance is an important implication. Constructivist teaching approaches emphasise the importance of the spatial and social environment for cognitive activities (Fürstenau, 2019). In this context, teachers should consider the journey to school as an integral part of the learning environment and consider appropriate pedagogical measures. As a teacher, it would be advisable to consider students' individual needs and plan interventions where necessary. For students with longer journeys to school, teachers could develop strategies to minimise stress and negative effects on performance. This could include, for example, promoting relaxation techniques, organising learning groups on the way to school or integrating movement elements into the school day.

The available results suggest that an active journey to school can have a positive impact on academic performance (García-Hermoso et al., 2017; Martínez-Gómez et al., 2011). This could motivate teachers to communicate the importance of an active journey to school to pupils and parents and to promote appropriate measures. A further impulse could include the organisation of journeys to school on foot or by bicycle, the promotion of sporting activities on the way to school or raising awareness of the choice of suitable means of transport. At this point, however, it should also be noted that an active journey to school is not practicable for all pupils. Accordingly, not all learners can benefit from it. In order to take these learners into account, it would also be conceivable to increase activity within the school day. For example, so-called movement breaks could be offered during school hours (Müller & Dinter, 2020, p. 155f). However, it should be noted that the available results are not conclusive and further research is needed to better understand the complex relationships between school travel behaviour, individual factors and academic performance. Overall, teachers should be aware that the journey to school is not just a physical transition from home to school, but an integral part of the learning

environment that can influence academic performance. By integrating this knowledge into pedagogical practice, teachers can help ensure that students can learn and develop under optimal conditions.

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