



Competence, Motivation and Interest Development Between Primary School and Tertiary Education—a Summary of Findings from the BiKS-8-18 Study

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Abstract

Within the BiKS-8-18 study (“Educational Processes, Competence Development, and Formation of Educational Decisions in Preschool and School Age”), the academic career of more than three thousand students from primary school up to tertiary education was observed. The longitudinal study design encompasses ten years of data collection on students, teachers and parents using a wide range of instruments. In this article, we summarize research findings on three major research questions. First, we discuss the development of reading comprehension in primary and secondary school, focusing on the exploration individual differences and the Matthew-effect. Second, we present research on students’ academic interests in secondary school and the role of social and dimensional comparisons

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for the development of individual differences. And third, we illustrate findings on the development of students' goals at the transition from secondary school to tertiary education. Finally, a comprehensive outlook is provided.

Keywords

Reading comprehension · Achievement goals · Academic interests

1 Introduction

Analyzing the development of students' cognitive competencies, motivation, and interest from primary school up to secondary school and tertiary education was one of the major aims of researchers from the Bamberg BiKS research group. Understanding success and failure, exploring individual trajectories of learners that will finally initiate university studies whereas others decide to leave school in an earlier point of their academic career in order to follow vocational training, was and still is of major importance: for politics and public administration, as it is for teachers, parents and every individual student. Starting in year 2006 with a first sample of more than two thousand third grade students, the BiKS-8-18 study followed the academic career for a total period of ten years and eleven waves of measurement (see Homuth et al. [this volume](#)).

Concerning the design of the BiKS-8-18 study, three principles were guiding. The first principle was the idea of analyzing students' competencies, interests and motivation longitudinally. In comparison to cross-sectional studies, this offers the possibility to describe interindividual differences as a developmental process in time, which allows a better understanding of causes and variables affecting students' education outcomes. Within the BiKS-8-18 study, students were observed between grade 3 and the beginning of university education and vocation training. This also allows the analysis of two critical transition points in the German education system: the transition from primary to secondary school, as well as the transition from secondary school to tertiary education. Second, within the BiKS-8-18 study, learning was considered as a process that is affected by various influencing factors and a plurality of stakeholders with different perspectives. Therefore, a wide range of instruments including competence tests, self-assessments and questionnaires or interviews were come into use. Furthermore, data collection encompassed children, teachers and parents. The third principle of the study was multicrateriality: In addition to academic achievement and competence development, psychosocial variables such as self-concept, interests, test-anxiety or school and family climate were observed. These variables were further analyzed as outcomes of education processes and decisions.

In the following sections of this article, we will illustrate major empirical findings using data of the BiKS-8-18 study. Thereby, we focus on three aspects of academic development: At first, we report major research findings on the development of reading comprehension in primary and secondary school. Then, we present research findings on the development of students' academic interests. Third, studies on the development of students' motivation with a specific focus on students' goals and goal orientations are presented. Finally, a summary and an outlook are provided.

2 The Development of Reading Comprehension in Primary and Secondary School

To read and to understand written text is essential for participation in the economic, cultural and democratic opportunities. Therefore, the teaching and learning of reading comprehension is at the core of education within schools all around the world. However, besides the claim that all students and adults should dispose sufficient reading skills in order to be able to master these demands, national and international comparisons such as PISA (Reiss et al. 2019), PIRLS (Hußmann et al. 2017) and PIAAC (Rammstedt 2013) have shown that a substantial proportion of students and adults have difficulties to fulfill these requirements. However, cross-sectional studies provide only short-term insights into individual careers. Therefore, it was one of the major aims of the BiKS study to better understand the development of interindividual differences in reading comprehension. Following a longitudinal approach, the BiKS study provides solid empirical data for the description of individual trajectories of students in reading. In addition, conditions and variables that have an influence and relate to these developmental differences can be explored.

The research and findings on the development of reading comprehension presented below are embedded in the theoretical concept of cumulative development in reading as described in detail by Pfost (2016). Focal points of this concept are: (1) reading skills develop in a continuous matter as current states arise out of preceding states and forces; (2) students are selected to and actively choose specific learning environments and conditions in line with their genetic disposition and prior learning experiences; and (3) without intervention to specific groups, interindividual differences in reading increase as students grow older (the Matthew-effect). We report findings from three different studies. First, the hypothesis of increasing individual differences in reading comprehension between grade 3 and grade 4 (the individual Matthew-effect) was tested. In the second study, differences in the development of reading comprehension between different secondary school tracks (the institutional Matthew-effect) were explored. And third, further

going into mechanism, findings on reciprocal relations between reading comprehension and extracurricular reading are presented.

In the first study, authored by Pfof et al. (2012), the authors were interested in analyzing the development of individual differences in reading comprehension in primary school. Relying on the idea that initial advantage begets further advantage (the Matthew-effect; Merton 1968; Pfof et al. 2014; Rigney 2010; Stanovich 1986), the development in reading comprehension of a subsample of poor readers in comparison to their normal and better reading classmates between grade 3 and grade 4 was analyzed. Poor readers were defined based on two criteria: The readers scored one standard deviation below the mean within the age-related population norm, as provided within the test manuals, in first reading fluency/reading speed, measured by the SLS 1-4-test (Mayringer and Wimmer 2005), and second reading comprehension, measured by the ELFE 1-6-test (Lenhard and Schneider 2005). Using latent growth curve models to analyze differences in the development of reading comprehension between these two groups of students, the poor readers showed a lower linear growth component in comparison to their better reading classmates. Due to differences in the quadratic growth component, this trend even accelerated over time. In an additional analysis within this study, the authors were further interested to know, whether such increasing difference in reading comprehension over time may be related to students' general cognitive abilities and students' reading behavior. The findings showed a clear relation to students' reading behavior: Increasing differences in reading comprehension were mediated by individual differences in frequency of extracurricular reading for pleasure.

In the second study, authored by Pfof and Artelt (2013), the authors were interested to know, whether, after the transition from primary to secondary school, students attending upper academic track schools (Gymnasium) differ in the development of reading comprehension from students attending lower (Haupt-) and middle academic track schools (Realschule). Within the German education system, students are stratified to different academic tracks mainly due to academic performance. Nevertheless, the final decision of a certain school track also depends on the parents. Further depending on the regulations of the federal states, school track choice there can be understood as an interplay between school recommendation and parents' will (Faust 2005). This may also result in students not attending the recommended school tracks (see Pfof et al. 2018, for findings on consequences of such decisions). Furthermore, it was assumed that school tracks differ with regard to the learning environments they provide, favoring academic competence development within the highest academic

track (Baumert 2006). Taken together, individual differences in reading development might be characterized not just by an individual but also by an institutional Matthew-effect. Analyzing the development of reading comprehension between grade 5 and grade 7, the results show higher competence gains for students attending upper academic track schools in comparison to middle and lower academic track schools (interestingly and contrary to the assumptions outlined above, an inverse pattern was found for vocabulary development). Furthermore, applying methods of propensity score matching, the authors explored differences in reading comprehension development between students attending upper academic track schools in comparison to students attending lower and middle academic track school under the precondition of comparable individual characteristics. Controlling for grade 4 competencies such as vocabulary, spelling, reading comprehension and mathematics, as well as variables such as reading self-concept or parents' education and migration background, results still show a minor positive effect of attending upper academic track school for reading comprehension. Although limitations such as small sample size lead to imprecise estimates, descriptively, attending three years upper academic track school in comparison to lower and middle academic track schools summed up to a difference in reading comprehension of about a third of a standard deviation.

And finally, in the third study, authored by Pfohl et al. (2010), the authors explored one of the assumed major mechanism behind the individual Matthew-effect in reading: the virtuous circle of reading or respectively the vicious circle of non-reading. Relying on prior research by Stanovich (1986), Morgan and Fuchs (2007), or McElvany et al. (2008), it was expected, on the one hand, that extracurricular reading positively affects students reading comprehension. On the other hand, higher reading comprehension was expected to result in comparatively higher reading engagement. Students' frequency of extracurricular reading for pleasure and students' reading comprehension between grade 3 and grade 5 were analyzed applying cross-lag panel models. Small but significant cross-lagged effects could be found: in addition to autoregressive effects, reading behavior had a positive effect on reading comprehension ($\beta = 0.15/0.08$). And vice versa, reading comprehension positively affected reading behavior ($\beta = 0.15/0.16$). Interestingly, in depth analyses showed, that within families of lower education background, no such cross-lagged effects were present. This has led to assume that, for example in addition to time and frequency of reading, moderating variables such as the quality of the reading material seem to be at work (see Locher et al. 2019; Pfohl et al. 2013, for further analyses on the moderating effect of text genre and text difficulty).

3 Students' Academic Interests—Patterns and Trends

It was one of the major aims of the Bamberg BiKS studies to incorporate a broader look on students' development through their education pathways. In addition to students' competencies, data collection and analyses also focused on individual differences in academic interests. Education attainment could be regarded from the perspective of skill and will. For example, good readers are not just capable of reading and understanding text, but also motivated and engaged in reading (Cambria and Guthrie 2010). Therefore, it seems little surprising that prior research has emphasized the role of individual interests for learning and competence development (Schiefele 1991; Schiefele et al. 1993). In line with the theoretical framework by Krapp (2002), academic interests were defined as a specific person-object relationship that is characterized by emotional- and value-related aspects. Individuals like to be engaged with objects respectively topics and activities that are of high personal significance and are accompanied of positive experiential states. Concerning the development of academic interests, several studies have shown a negative trend on the development of school subject-interests as students grow older (Dotterer et al. 2009; Jacobs et al. 2002; Schurtz and Artelt 2014). Therefore, despite an increase of academic competencies in the course of schooling, students often become less interested in their school subjects, which is likely to flatten out academic development. However, recent studies also indicate that interest stagnates in late adolescence and even tends to increase to the end of secondary school (Dotterer et al. 2009). The mean drop of interest over time is often explained by a process of interest differentiation (Todt and Schreiber 1998): In the course of schooling, students focus their interests on a few subjects, while interests in the remaining subjects decline. Both assumptions were explored by Schiefer et al. (2018), who analyzed longitudinal data on students' school subject-interests in German language arts, English and mathematics. Analyses encompass seven waves of measurement between grade 4 and grade 11. First, results show a decreasing trend in subject-interests between grade 4 and grade 9. However, between grade 9 and grade 11, a slight descriptive increase in students' subject interests was observed. Furthermore, correlations between subject-interests in English and mathematics decreased over time, congruent to the assumption of a differentiation process between these two subject-interests. Second, latent class analyses revealed five latent classes, which show quite different patterns of the development of students' school subject interests. However, only within two latent classes a developmental pattern congruent to the

assumption of increasing differentiation of interests was observed. This points to the perils of a variable-centered approach and the advantage of a person-centered approach: Just focusing on a general trend in interest development not necessarily applies to a majority of students. When taking a closer look, different patterns emerge. This opens the field for the search on further variables explaining causes of these different trends.

Therefore, within the study by Schurtz et al. (2014), the development of students' academic interests in mathematics and English (as the first foreign language) was analyzed in relation to students' individual competencies and school grades in the two school subjects. Furthermore, students' class context was considered. The study basically relied on two theoretical assumptions: First, according to the internal/external frame of reference model (I/E model; Marsh 1986), it was assumed that academic competencies within the mathematics/ English domain were positively related to students' subject interest within the mathematics/ English domain, but negatively related to students' subject interest within the non-matching domain. Second, by relying on the big-fish-little-pond-effect model (BFLPE; Marsh 1987), it was expected that the average achievement level of the class context within one domain was negatively related to the students individual interest within this domain. Therefore, average achieving students should feel less competent and develop a lower subject interest within this subject within high-achieving classes in comparison to low-achieving classes. Analyzing data of 1390 sixth-grade secondary school students within 106 classes, these two assumptions were tested separately as well as in a joint model using a multi-level modeling approach. The empirical findings well supported the theoretical assumptions: First, students' mathematics competence was negatively related to students' English subject interest and students' English competence was negatively related to students' mathematics subject interest. This supports the I/E model of dimensional comparisons. Second, average class achievement in mathematics and English negatively affected students' mathematics and English subject interest, supporting the BFLPE model. Third, with the exception of the dimensional comparison effect of mathematic competence on English subject interest, effects of social (BFLPE) and dimensional (I/E model) comparisons remained stable when both effects were considered simultaneously. Fourth, within both domains, at least a partial mediation of both comparison effects via students' individual grades and self-concept was found. Finally, this pattern was also found for the development of students' subject interest in mathematics and English from grade 5 to grade 6. In sum, the development of students' school-subject interest has shown to be complex as it is influenced by different standards of comparison.

4 The Development of Students' Goals at the Transition from Secondary to Tertiary Education

Goals and goal striving affect our daily thoughts and actions. Especially for students shortly before leaving school, goals can be seen as “navigating tools” for successful transition from school to tertiary education and future career (Litalien et al. 2013; Nurmi 2001). Previous research has shown that some goals are more beneficial than others. Especially goals which individuals pursue for intrinsic reasons (e.g., interest, enjoyment, etc.) seem to have a positive impact on variables such as well-being or educational performance (e.g., Anderman et al. 2002). Furthermore, goals and goal striving can be specified according to the situation or context in which they were set. For example, life goals can be seen as a kind of broader goals, which are relevant in different situations or contexts. More specific goals may structure certain situations such as goal orientation in educational settings. Goal orientation theory concerns the questions of how and why individuals behave in certain ways in different learning and performance situations. One of the empirically most well-documented finding for goal orientation development is a decrease in mastery-goal (the aim of developing one’s own competencies and skills as well as learning new things) and an increase in performance-goal orientation (the aim of demonstrating one’s own competencies and skills) after the transition from primary to secondary school (e.g., Anderman and Midgley 1997). One possible explanation for this development is that changes in contextual conditions result in a misfit between a learner’s needs and the learning environment (Eccles et al. 1993). Another explanation are evident goal structures in the classroom. These provide a theoretical framework describing different teaching practices and the learning atmosphere as either mastery or performance oriented (Roeser et al. 1996) and which affect students’ motivation.

However, findings on the further development of goal orientation and its relation to educational transitions within older students are scarce. One of the major goals of the BiKS study was the examination of the development of goal orientations and the description of influencing factors (e.g. parental motivation, environmental factors). Furthermore, correlations with other motivational constructs like life goals in students and young adults are analyzed. By using a longitudinal approach, the results of three studies provide important empirical insights into motivational development and explanatory factors from secondary school up to the transition into university or vocational training.

In the first study, authored by Becker et al. (2017), the authors examined the development of students’ goal orientation at the beginning of secondary education as well as during the transition from secondary school to higher secondary

education (grade 11). In addition, the authors compared the results with peers who started a vocational training after graduating from secondary school. To examine whether the transition to vocational training is associated with a better fit between learners' needs and the learning environment, individual reasons for choosing the field of vocational training were also analyzed. For students who moved to higher secondary schools, the authors expected an increase of performance goal orientation because the learning environment is quite competitive with a strong focus on grades. In contrast, for students who started vocational training, an increase in mastery goal orientation was expected, because these students can to a greater extent choose their training according to individual competencies and interests. This is a key factor for an optimal stage-environment fit. Concerning the development of mastery goals, the results show at first decreasing mastery goals at the beginning of secondary education. This was followed by an increase in mastery goals between grade 6 and grade 11. In addition, this increase in mastery goals was stronger for students who started vocational training in comparison to students who moved to higher secondary schools. Furthermore, it was assumed that this increase, especially in the group of trainees, might be related to a better stage-environment fit and changes in the goal structure of the new learning environment. This assumption found support in the data: an indicator of the reasons for choosing vocational training, which might be seen as a proxy of the perceived fit, showed that almost all trainees started the vocational training that corresponded to their first choice. In addition, the results show that interest, talent, and previous experience were the main reasons for their choices. Finally, the results show a decrease of performance goal orientation in both groups.

The second study, authored by Becker et al. (2018), focused on the question whether the increase of mastery goal orientation after the transition into upper secondary school or vocational training, which was found in study 1, could also be observed two years later, when students have graduated from higher track secondary school and have started university or vocational training. Additionally, the authors were interested in the further development of goal orientations of the trainees who chose vocational training earlier. The authors further explored the fit between the students' needs and the conditions in the new educational context to elaborate on the fit hypothesis. Therefore, students' internal (interest, talent, previous experience) and external (earning opportunities, reputation, admission requirements) reasons for choosing the field of study at university or vocational training were analyzed. The results indicated increasing mastery-approach goals for higher track graduates after they transitioned to a new educational context. Furthermore, there was a slight decrease in performance-approach goals. Additionally, an adequate fit between the learners' needs and the new educational

context was found as graduates on average stated more internal than external reasons for choosing a field of study or vocational training. Within the group of students who started early vocational training after grade 10, mastery-approach goals seem to remain stable during three years of vocational training. Furthermore, students who started early vocational training reported higher performance approach goals in time 1 (grade 11/1st year of vocational training) in comparison to their peers who stayed at higher track school. However, between the 1st and 3rd year of vocational training, performance approach goals decreased. The decrease in performance approach goals over time was stronger for students who started early vocational training in comparison to higher-track graduates.

An explanation that is compatible with these results is the theory of goal structures, which postulates an impact of contextual conditions, teaching methods, and learning atmosphere on the development of goal orientation (e.g., Roeser et al. 1996). In particular, previous studies have shown that vocational training emphasizes the development of subject-specific competencies and their practical implementation (Pätzold 2006; Weigel et al. 2007), and therefore provides a mastery-oriented learning environment. Furthermore, after the transition to university or vocational training, students reported decreasing performance-approach goals. According to the theory of goal structures and its impact on the development of goal orientation, it is to hypothesize that the new learning environment is characterized less by performance-approach goal structures, which could be an explanation for the observed decrease of performance approach goals.

Taken together, study 1 and 2 emphasize the impact of the transition from school to a new educational context on the development of goal orientation. We assumed that an increasing fit between the learners' needs and the contextual conditions results as a consequence of the transition to a new learning context which finally leads to changes in motivation. The transition to a new learning context, university education and vocational training, which have both shown to be predominantly chosen by internal reasons like interest or talent, seems to motivate students intrinsically.

In addition to the development of motivational constructs like goal orientation, we were also interested in analyzing relations between different motivational constructs. Thus, the purpose of study 3, authored by Becker et al. (2019), was to examine relations between different types of goal regulation in specific contexts and education-related parenting behavior as explanatory variable. For this sake, the authors analyzed life goals, their regulation and goal orientation of students in their last year of higher track school (grade 12). As already mentioned, goal-related behavior can be structured according to a hierarchical model describing goals as ranging from a global, broader level to a more situational one (e.g.,

Carver and Scheier 1999; Vallerand 1997). For the regulation of life goals, as an example for broader goals which can be relevant in different situations, we rely on the theoretical framework of self-determination theory (Deci and Ryan 1985, 2000). In this framework, four types of regulation are described according to a person's level of perceived autonomy during the process of goal striving: extrinsic, introjected, identified, and intrinsic regulation. For goals on a lower level of the hierarchical structure and within a more specific context, we focused on goal orientation—students' mastery and performance goals.

First, by using a person-centered approach, the results show three different profiles of life-goal regulation. The main differences between these three profiles appear according to the amount of more extrinsic types of regulation, which encompasses both introjected and extrinsic regulation. The first latent class is characterized by quite low scores on all four regulation types. The second latent class reported highest scores on intrinsic regulation and had average to high scores on identified regulation. Finally, the third latent class was characterized by the highest scores on introjected and extrinsic regulation. Furthermore, meaningful associations between these life goal regulation profiles and goal orientation were found. In line with theoretical assumptions in the context of goal hierarchies, the life-goal regulation profiles, as an example of higher ordered goals, predicted goal orientation, which can be seen as goals on a lower level. This relation could be observed in particular for goals with more extrinsic characteristics. For example, the authors found students within latent class three, which is characterized by more extrinsically oriented types of life-goal regulation, to also report higher performance-approach goals. Finally, prior research has shown that goal-related behavior is influenced by different external variables (Lekes et al. 2010; Massey et al. 2008). Searching for precursors of patterns of goal orientation, the authors tested whether parental behavior during childhood still relates to goal regulation in grade 12 students. Consequently, the prediction of education-related parenting during secondary school (grade 5–9) for later goal regulation of their grown-up children was explored. The empirical results show that goal-related behavior in adolescence could be predicted by external factors like education-related parenting.

5 Summary and Outlook

The BiKS-8-18 study provides a rich data base on the development of competence, motivation and interest from students aged 8 to 18. Concerning the developmental trajectories of reading comprehension, we found support for an overall

tendency of increasing achievement gaps, on the one hand on an institutional level and on the other hand on an individual level. These findings are in line with the Matthew-Effect (Stanovich 1986) and theories of practice engagement (e.g., Reder et al. 2020). The particular importance of reading engagement and practice has also been proven in recent studies from adult samples: Drawing on data from Starting Cohort 6 (Adults) of the German NEPS, the subgroup of low-literate adults was identified using a bookmark standard-setting procedure (Durda et al. 2020). After six years, 32% of these low-literate adults ascend to the group of literate adults, particularly if they indicate more reading practices (Wicht et al. 2021). Likewise, reading practices appear to be an important protective factor of descending from the higher literacy to the lower literacy group. Reading literacy thus is not set in stone: Reading practice not only contributes to growing disparities (Matthew effect) but also serves as a protective factor and can lead to improvement in reading comprehension. Nevertheless, the link between conative, cognitive and affective variables on the individual level and—partly as a consequence of selection mechanism—also on the contextual level is strong, opening a wide field for future research and intervention practices.

Elaborating further on the role of conative, cognitive and behavioral factors, the results of the BiKS-8-18 study on interest development can be summarized as follows: Despite the well-documented decline of students' academic interest over the school years, which is in line with the process of interest differentiation, interest still matters for educational attainment. We were able to show evidence for interest differentiation processes for some students. In line with the literature, overall we observed first a decrease in academic interests, which was followed by an increase in interests in grade 11. In addition, interest differentiation was observed in grade 11 for two out of five latent classes. Therefore, students tend to differ in processes of individual development of school subject-interests. However, future research is needed in order to better understand these interindividual differences in intraindividual change of students' academic interests. Furthermore, the development of students' academic interests in two subject domains in relation to students' individual competencies and school grades in the corresponding and non-corresponding school subjects (referring to the I/E model; Marsh 1986) as well as in relation to students' class context (BFLPE; Marsh 1987) were analyzed. We thereby found evidence supporting both, the I/E model of dimensional comparisons and the BFLPE model and were able to show that effects remained stable (with one exception) when both effects were considered simultaneously. Furthermore, the effects were partly mediated via students' grades and self-concepts. Taken together, the development of students' school-subject interest seems to be influenced by different standards of comparison, in interplay with evaluative

and achievement-related variables. Therefore, when it comes to the practical question of how to promote students' interests in school learning and how to prevent the often observed negative trend in school subject interest in the course of secondary school, these different standards of comparisons are important to consider (see Schurtz and Artelt 2014; for further findings using data from the BiKS study).

Then, we analyzed the role and developmental dynamics of goals and goal regulation. Parallel to the decrease in interest development at the transition from primary to secondary school, mastery goals are often reported to decrease whereas performance goals increase (e.g., Anderman and Midgley 1997). However, when studying the development of goal regulation beyond the first years of secondary school, we were able to show differential patterns. We found an increase in mastery goal orientation, which occurred especially for students after transition to vocational training. Furthermore, and line with our theoretical assumptions, this increase turned out to be related to a better stage-environment fit and changes in the goal structure of the new learning environment. Comparable results were found for students graduating two years later from higher track secondary school and who start university or vocational training. The results showed that in the course of transition to a new learning context, the subject of tertiary education and the type of vocational training was predominantly chosen by internal reasons. Finally, we examined the relations between different types of goals and goal regulation together with education-related parenting behavior as explanatory variable. Our findings show meaningful associations between life goal regulation profiles and goal orientation as life-goal regulation profiles predicted goal orientation. Furthermore, the association between education-related parenting behavior and students (later) goal orientation can be regarded as a proof of external factors affecting goal related behavior. In sum, our results on goals and goal regulation show both, dynamic and stable processes of motivational behavior. Dynamic patterns occur especially after transition into self-chosen environments (stage-environment fit). Stable processes and patterns on the other hand were predicted by students' individual needs and environmental conditions, including parental behavior.

Taken together, whereas cross-sectional comparative education studies such as PISA, PIRLS or PIACC, which are characterized by large sample sizes, provide valuable insights into education outcomes at key stages of the education systems, longitudinal studies such as the BiKS study provide a good empirical basis for the analysis of possible explanations and mechanism. Since in the meantime, in addition to the BiKS study, numerous other longitudinal studies in education

research have been conducted and are available for analysis purposes, further research findings on competence, interests and motivation development remain to be seen.

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