

https://dspace.org/

Equality in the public Hessian school system: a quantitative analysis of the state resource allocation to primary schools based on per learner unit costs

Giegerich, Udo

2014-11-10
http://hdl.handle.net/10539/15854

Downloaded from a DSpace repository. https://dspace.org/

RESEARCH REPORT

Submitted in partial fulfilment of the requirement

for the degree of a Master in Education (Policy, Planning and Management)

School of Education

University of the Witwatersrand

Equality in the Public Hessian School System:

A Quantitative Analysis of the State Resource Allocation

to Primary Schools Based on Per Learner Unit Costs

PREPARED BY:

Udo Giegerich

Person No. 375156

SUPERVISOR:

Professor Brahm Fleisch

January 2011

Acknowledgements

I would like to express my sincere appreciation and gratitude to the following people:

- To Professor Brahm Fleisch for his support and mentorship.
- To Helen Perry for her patient guidance, comments and support.
- To the Ministry of Education Hesse for kindly allowing the research and for providing the data.
- To various colleagues of the Ministry of Education Hesse for their support and advice.
- Finally, to my family, Verena, Leon, Thilo and Nele, for their patience, support and understanding.

Abstract

Equal learning conditions are enshrined in German Basic Law. As a consequence of the federal structure of Germany the 16 states are responsible for educational concerns and have different resource allocation systems. Even within states the distribution of resources varies because of the involvement of regional education offices.

This study determines the equality of the resource allocation system for the state of Hesse regarding pure primary schools. The innovative aspect of this study is the use of real cost data at the school level provided by the new Hessian accounting and human capital management system.

Per learner unit costs are the basis for the analyses and the main focus of the study. Correlations between unit costs and school variables (school size, urbanisation, gender, migration, special needs, class size, social status and learner results) are also examined.

The findings highlight that the dissemination of resources in Hesse is not equitable on the basis of per learner unit costs. The resources at the school level vary for example by district and schools size.

The analyses of the correlations between unit costs and school variables show a resource disadvantage to schools in mostly urban districts and with a higher proportion of learners with a migration background. The scrutiny of correlations between the school variables points out that the social status of a school and the learner achievement have a strong negative correlation with the proportion of learners with a migration background.

The study recommends a change of the resource allocation in Hesse from the current “reference classes” to per learner unit costs with a consideration of the social status of a school as well as improvements in the school structure (e.g. merging small schools in rural areas) in cooperation with the districts. Further research for other types of schools is necessary because the focus of this study is on pure primary schools. In addition the cost assignment of the accounting system for schools should be improved to get a better data quality for further cost analyses.

Table of Contents

Acknowledgements 2

Abstract 3

Table of Contents 4

List of Tables 5

List of Graphs 6

Abbreviations 7

1. Introduction 8

2. Equality in Education: The Literature 15

3. Methodology 19

4. Analysis of the Data 27

5. Conclusion 49

References: 54

Appendices 57

List of Tables

Table 1: Descriptive figures about the school system in Hesse
Table 2: Analysis of average unit costs for general teaching
Table 3: Analysis of weighted average total unit costs for general teaching state level
Table 4: School variables overview
Table 5: Analysis of correlations between average total unit costs for general teaching and school variables
Table 6: Analysis of correlations between average personnel and other recurrent unit costs for general teaching and school variables
Table 7: School size classes
Table 8: Number of schools per school size class
Table 9: Analysis of weighted average total unit costs for general teaching regarding school size classes
Table 10: Simple average total unit costs for general teaching 2008 per district
Table 11: Simple average total unit costs for general teaching 2009 per district and variation to 2008
Table 12: District size classes and number of Hessian districts in the different district size classes
Table 13: District size classes and corresponding simple average total unit costs for general teaching
Table 14: Analysis of correlations between simple average total unit costs for general teaching, school variables and district data
Table 15: Analysis of weighted average total unit costs for general teaching district level 2008
Table 16: Analysis of weighted average total unit costs for general teaching district level 2009
Table 17: Analysis of correlations between weighted average total unit costs for general teaching and school variables
Table 18: Analysis of average total unit costs for additional support of handicapped learners
Table 19: Analysis of correlations between average total unit costs for additional support of handicapped learners and school variables
Table 20: Analysis of average total unit costs for additional support of learners with migration backgrounds
Table 21: Analysis of correlations between average total unit costs for additional support of learners with migration backgrounds and school variables
Table 22: Analysis of correlations between school variables

List of Graphs

Graph 1: Analysis of simple average unit costs for general teaching and school size
Graph 2: Analysis of correlations between average total unit costs for general teaching and school variables
Graph 3: Analysis of weighted average total unit costs for general teaching regarding school size classes
Graph 4: Analysis of simple average total unit costs for general teaching by districts
Graph 5: Analysis of average total unit costs for additional support of handicapped learners
Graph 6: Analysis of average total unit costs for learners with migration backgrounds

Abbreviations

GU	Support for handicapped learners / inclusive teaching
MIG	Support for learners with migration backgrounds
U	General teaching
%FEM	Proportion of female learners
%Handicapped	Proportion of handicapped learners
%MIG	Proportion of migrant learners
avg	Average
EMIS	Education Management Information System
ERP	Enterprise Resource Planing
GDP	Gross Domestic Product
GNP	Gross National Product
HCM	Human Capital Management
KDW	Kultus Data Warehouse
KMK	Standing Conference of the Ministers of Education and Cultural Affairs
MoE	Ministry of Education
OECD	Organisation for Economic Co-Operation and Development
ORC	Other Recurrent Costs
PC	Personnel Costs
SAP	German software corporation that provides ERP software applications and services
TIMSS	Third International Mathematics and Science Study
uc	Unit Costs
UNESCO	United Nations Educational, Scientific and Cultural Organization

1. Introduction

The aim of the study is to assess the equality of the state resource allocation to pure primary public schools in the German state of Hesse on the basis of per learner unit costs as well as to evaluate cost variations and correlations with key education indicators (school size, social status, learner achievement, class size, gender, urbanisation, immigration, special needs). The major innovative aspect of the study is the use of real cost data at the school level in combination with data about the social status of the learners and learner results in the state wide reading tests of Hesse.

1.1 Background / Context

The Basic Law for the Federal Republic of Germany obliges in Article 3 (German Bundestag 2009) that everyone is equal under the law and nobody should be disadvantaged. Article 7 says that each German state is responsible for education and in combination with Article 3 it means that the state is responsible for equal learning conditions.

In Germany there is a special situation regarding the responsibilities in the education sector: the 16 federal states are responsible for education concerns according to the German Basic Law and the 16 state constitutions[1]. The federal government only has some co-ordinating authority over vocational training and the tertiary sector. The whole school system is controlled by the state governments. This leads to 16 different education systems within one federal nation. The states have the authority for[2]:

- educational objectives,
- institutionalization of the education system (e.g. establishment of schools),
- regulations for access and graduation / certification,

[1] For details see: http://www.verfassungen.de/de/index.htm; last viewed 19.11.2010

[2] For details see: http://www.kmk.org/information-in-english/standing-conference-of-the-ministers-of-education-and-cultural-affairs-of-the-laender-in-the-federal-republic-of-germany/organization-and-proceedings.html; last viewed 19.11.2010

- compulsory school attendance,
- provision of resources for the education system out of the own state revenues (e.g. financial resources, personnel, infrastructure) and the sectoral / regional dissemination,
- organisation of teaching, teacher training,
- curricula, education standards, accreditation criteria and
- quality assurance (e.g. evaluation, school inspections, cost accounting).

To coordinate the states and to find agreements on education concerns the Standing Conference of the Ministers of Education and Cultural Affairs (KMK) was founded in 1948. The KMK also has responsibilities for coordinating international cooperation, developing / setting the standards of educational outcomes for the federal states and education monitoring[3]. However all states have their own system of distributing resources and different macroeconomic conditions (e.g. one reason is the integration of Eastern Germany). There are different resource volumes for the education sector in the different states.

In Hesse the districts are responsible for local school development (local school structure as well as the establishment of schools) and the funding of non-personnel-costs except learning materials (e.g. books). The state funds teachers and learning materials. The existing formula for the main resource - teachers - in Hesse is based on class size and teaching hours with additional funds for special needs (e.g. disabled learners and immigrants). The learning materials are calculated by learner numbers. The dissemination of the state resources to the schools is undertaken by regional education offices of the state. Because of these different regional / local distribution processes and different school structures, even within the state of Hesse, differences in resource allocation to schools could occur.

[3] For more information about the KMK and the German education system see: http://www.kmk.org/information-in-english.html; last viewed 19.11.2010

In 2003 a new human capital management system (SAP HCM) and in 2007 a new accrual accounting system (SAP ERP) was introduced in the public administration in Hesse (including the education sector). These new systems allow a bottom up analysis of real school expenditure and not only on the basis of formulas as in the past. It is now feasible to assess the real unit costs per learner as a proxy for the equality in learning conditions codified in the German Basic Law at the school level.

To get a better understanding of the Hessian school system some descriptive figures (school year 2008/2009[4]) and an explanation about the possible school career paths are given below:

Table 1: Descriptive figures about the school system in Hesse

Description	**Figure**
Inhabitants Germany	82.002.356 (31.12.2008)
Inhabitants Hesse	6.064.953 (31.12.2008)
Inhabitants Hesse with foreign nationality	674.276 (31.12.2008)
GDP Hesse[5]	216.721 Mio € (2007)
Total expenditure government Hesse	27.247,3 Mio € (2008)
Total expenditure education sector Hesse (without tertiary education)	4.373,0 Mio € (2008)
Number of schools in general-education Hesse	1.892
Number of schools in vocational training Hesse	160
Number of primary schools Hesse	1.191
Number of learners Germany	11.831.101
Number of learners Hesse	873.502
Number of learners in private schools Hesse	46.483
Number of learners with foreign nationality Hesse	103.485
Number of learners in public primary schools Hesse	224.863
Number of teachers Germany	713.287
Number of teachers Hesse	57.384
Number of teachers in public primary schools Hesse	10.921

[4] Source: http://www.kultusministerium.hessen.de/irj/HKM_Internet?cid=51fded10bb843cb5ff1c7d63a20104f3; last viewed 19.11.2010

[5] Source: http://www.statistik-hessen.de/fileadmin/media/files/hessen_in_figures.pdf; last viewed 19.11.2010

Career paths[6]:

School attendance in Hesse is mandatory between the ages of six and eighteen. All children attend primary school (up to grade 4). After primary school they can take one of four school paths: Hauptschule, Realschule, Gymnasium or Gesamtschule, based on their performance at the primary level. In the Gesamtschule (comprehensive school, grades 5 to 10) the traditional school paths are integrated or exist co-operatively. Learners at comprehensive schools can achieve their Hauptschul-graduation in grade 9 or 10, and their Realschul-graduation or the permission to attend a Gymnasium in grade 10. Graduation from Hauptschule can be achieved in grade 9 or 10 and Realschul-graduation in grade 10. Hauptschul- and Realschul-graduates begin a co-operative or full-time vocational training programme (work and school). The above mentioned co-operative vocational programme, called Duales System, is a combination of work in the field and parallel schooling. Gymnasium learners continue attending the Gymnasium for two or three years, where they receive their Abitur-level degree, enabling them to apply at university. Special education schools accommodate all learners who do not fit in the traditional paths due to various handicaps. Private schools are an alternative to all public schools, but are still less established than they are in other European countries.

1.2 Research Question

The general topic of the study is equality in resource distribution in education. The focus is on the school sector in Germany. And because of the federal responsibilities in Germany the state of Hesse will be assessed. To concentrate the scope of the study only pure primary public schools[7] will be observed.

So the leading research question reads: “Is there equality in the allocation of the state resources in the

[6] Source and further information: http://www.partners-in-education.com/pages/germany/prolog_germany.html; last viewed 19.11.2010

[7] Pure primary schools are not combined with other school types (like lower secondary schools).

public Hessian school system regarding pure primary schools based on per learner unit costs?"
The study analyses the latest available real expenditure data on the micro perspective (school level), not only the results of distribution formulas and will contribute to the literature on equality in education regarding the German state of Hesse.

1.3 Rationale / Significance of the Problem

The aim of the study is to evaluate whether Hesse has fulfilled the constitutional obligation of providing an equitable resource allocation or not. The hypothesis is that due to the different structures and different allocation processes within school districts the unit costs per learner may vary even within Hesse between comparable schools.

The actual Hessian teacher allocation formula for general teaching is based on the following principle:

- the number of learners in the last school survey (from October of the previous year);
- the reference class size (for primary schools this is 28 learners);
- the reference number of teaching hours per class (primary schools school year 2008/2009 grade 1/2: 21,7 hours per week, grade 3/4: 25,7 hours per week);
- the reference number of teaching hours per teacher (for primary schools in school year 2008/2009 28,75 hours per week).

The result of the division of the number of learners by the reference class size is the number of reference classes. This number will always be rounded up and multiplied with the reference number of teaching hours per class. The total sum of teaching hours is then divided by the reference number of teaching hours per teacher to get the number of teacher posts needed. This calculated demand of teacher posts is allocated to the regional education offices that have the authority to distribute the teacher resources to the schools. Since the school year 2009/2010 (which began August 2009) the teachers were directly distributed from the Ministry of Education to the school level. But the regional education offices still have the competence to shift teacher resources during the school year (after the initial resource allocation). The minimum class size for primary schools is 13 learners, the reference /

maximum class size is 28 learners. Larger classes will be split, smaller classes should be merged (even over grade levels; e.g. grades 1-2 together). But this is at the discretion of the regional education offices.

The payment for the teacher posts in the pure primary schools is uniformly 48.303 € per year (without accruals for pensions and sickness cover; value 2008). Only the head teachers and their deputies earn more depending on the school size (from 53.628 € to max. 61.886 € per year; values 2008).

The additional teacher resources for handicapped learners are allocated separately according to the number of handicapped learners. The supplementary teacher posts for the support of learners with migrant backgrounds are distributed in two ways. About 140 posts are allocated directly from the Ministry of Education to schools with a proportion of 45% or more migrant learners. An additional amount of about 1.000 teacher posts are distributed by the regional education offices to the school level on a similar basis. These additional resources are the Hessian attempt to teach learners with special needs / handicaps and migrant backgrounds together with their regular German schoolmates.

For school heads there is a relief from teaching for school management. The obligatory teaching hours per week of a teacher in primary school are 28,75. The relief base rate for school heads in primary schools are 11 teaching hours per week plus further relief of 0,0424 teaching hours per week per learner.

The allocation of the main other recurrent costs is differentiated by the type of resources:

Textbooks / learning material

Resources for textbooks / learning material are allocated to schools with an annual per learner cost rate depending on grade:

Grade	**€ per learner**
1	30,50
2	13,70
3 - 4	19,40

Teacher training

Funds for teacher training are distributed with an amount of 40 € p.a. per post for general teaching at the school level.

Teacher replacement

Schools get 1.000 € p.a. per general teaching post for short term teacher replacement.

IT-support

For IT-support schools receive 113 € p.a. per post for general teaching.

As an assumption there could be variations / privileges for specific situations e.g. school sizes and / or districts and not even the constitutionally intended equality in resource allocation is reached.
The study contributes to the evaluation of the resource dissemination practice in Hesse with regard to equality, because this has not been done in the past under the scope of real school based unit costs per learner. Furthermore there is actually very little literature about education equality based on per learner unit costs in Europe as well as Germany and especially in Hesse. The study could begin to create literature to fill this gap.
If there are important findings, policy changes about the actual resource allocation system in the Hessian school sector could be possible and the findings could be used to optimize the overall Hessian school structure in cooperation with the responsible districts to equalise school resource allocation.

2. Equality in Education: The Literature

The literature review shows that there is limited literature about the issue of unit costs at the school level as a proxy for resource equality either in Europe, Germany or Hesse. The broader framework for the study is equity. "Equity" itself is subject to a broad range of interpretations and discussions. First of all "equity" is "a fundamentally important concept that can be used to characterise the fairness and effectiveness of education systems" (Sherman & Poirier, 2007: p17). Furthermore it is conceived as a basic human right (Cavicchioni & Motivans, 2001). Because of this rights-approach governments have to deal with issues regarding educational equity.

This study focuses on the three standards of equity that Fiske & Ladd (2004) state in their analysis of racial equity in post-apartheid South Africa:

Equal Treatment

Equal treatment means that no one should be treated differently because of their personal characteristics. With regard to resource distribution this equity standard points out that everyone should get the same amount of resources irrespective of their personal situation (Fiske & Ladd, 2004).

Equal Educational Opportunity

This equity standard is broader than „equal treatment" and takes into account the potential of education attainment. It calls for affirmative action to redress disadvantages (e.g. because of migration status or social status). The resource amount under that distribution standard should be different depending on need (Fiske & Ladd, 2004).

Educational Adequacy

This equity standard shifts the focus from educational inputs to educational outcomes. It means that educational equity is only given if a minimum acceptable or adequate level of education is reached (Fiske & Ladd, 2004). The resource distribution is here oriented at learning achievement.

Berne & Stiefel (1994) apply a very similar framework to characterize the different principles of equity at the school level. With regard to educational inputs they use the terms „Horizontal Equity" for „Equal Treatment" and „Vertical Equity" instead of „Equal Educational Opportunity".

With regard to the international literature the United States of America has a long tradition of assessing equity in educational costs because of legal challenges to the very different local funding for public schools. Between 1971 and 1996 opponents challenged successfully the constitutionality of school-finance systems in 16 states (Murray, Evans & Schwab, 1998). In the case of Kentucky the decision of the Supreme Court in 1989 lead to a broad education reform that ended up with a changed aid formula on a per-learner basis. The financial part of the reform reduced the disparity in per-learner spending by creating a state-funding formula that substantially equalizes resources at the district level (Hunter, 1999). California´s Supreme Court declared that "the quality of education may not be a function of wealth other than the wealth of the state as a whole" (Berne & Stiefel, 1999: p8). However, the focus of the mentioned U.S. literature is mostly on the formula based per-learner funding at a district-level, not on real costs at a school level.

In Europe and most of the other OECD-Countries the research focus is less on equal treatment or equity in resource allocation but more on educational adequacy with regard to educational outcomes. Hanushek & Luque (2001: p23) found that "Across the sampled TIMSS[8] countries, the overall strength of resources in obtaining better learner performance appears rather limited." Hanushek and Woessmann (2007) also stated that simple resource policies (like reducing class size or spending more on schools) have little impact on learner performance. This finding also applies to Germany and the state of Hesse. Woessmann (2007) showed that the learner outcomes in the German states are not associated with the resource endowment of schools. The literature regarding Europe, Germany and Hesse also is not about equality on the basis of real per learner unit costs per school. It is more on educational adequacy and efficiency as measured by national or state-wide average per capita costs.

Bray (1988: p7) reviewed the international evidence on the relationship between school size and unit costs. He found that there is a lack of information about this issue, but not a lack of importance for

[8] TIMSS: Third International Mathematics and Science Study

decision-makers. He stated that ”Very rarely do budgets show the expenditure in individual schools; usually they show only the aggregate expenditure on salaries, equipment, maintenance, etc. In some contexts it also reflects the lack of a research tradition.”.

Actually there is a strong need for this kind of data because of the demographic development of rural population also in Germany (reduced population and learner numbers in rural areas) and the need to change rural school structures (e.g. merging small schools). But the study only observed the UK, USA, Canada, Australia and Sudan.

A number of studies have looked at unit costs and equity in developing countries. Colclough and Al-Samarrai (2000) examined the public expenditure data for Sub-Saharan Africa and South Asia. They used national level data to compare relative unit costs as well as unit costs per child as a proportion of the Gross National Product (GNP) per capita. But they do not focus on real school level data and Germany / German states.

A unit cost analysis on secondary education in Uganda focused on the differences between private and public schools regarding spending and learner achievement (Jacob, Holsinger & Mugimu, 2008). They computed unit costs by identifying, evaluating and aggregating the cost components in analogy to Jarousse, Mingat & Tamayo (1996), but also not at the school level and not for other nations.

Sherman and Poirier (2007) assessed for UNESCO the educational equity and public policy of 16 countries regarding among other things the expenditure per learner. They found from the analysis of the horizontal equity measures that there is a wide range between the highest and lowest regional expenditure per learner within the countries. But unfortunately Germany and the German states are not included in the study.

In a study in 2006, Shireen Motalla states that a disaggregated analysis of educational costs at a school level is a significant methodology because aggregated data says little about the actual impact of equity and redress measures on the ground. Her bottom-up approach using actual unit costs is a feasible way to research education financing, but her study only focuses on South Africa.

Klein & Plünnecke (2010) from the Cologne Institute for Economic Research examined in a study the

per learner expenditure in Hesse[9]. They figured out that the resource allocation should be on a per learner basis and not institutionally oriented. But they also used aggregated expenditure data at the state level, not real per learner unit costs at the school level.

As the previous literature review shows there is no relevant research on equality based on real per learner unit costs at the school level for Germany and Hesse. Partly there is evidence for other countries. To some extend research exists based on aggregated expenditure data or on allocation formulas, but this only allows for methodological and theoretical analyses.

In contrast this study analyses real per learner unit costs at the school level for Hesse. It should fill the literature gap in this regard and should contribute to the broad international research knowledge about equality in schools.

[9] The study is unfortunately only available in German.

3. Methodology

3.1 Mode of Inquiry

The mode of inquiry of this study is secondary data analysis. This research approach uses data gathered by the SAP accounting system and the Kultus Data Warehouse[10] (KDW) of the state of Hesse to analyse relationships between measured variables of the education system. It is a quantitative non-experimental design and will analyse data from all pure primary public schools in Hesse. A quantitative non-experimental design tries to maximize objectivity by using numbers, statistics, structures and control without any direct manipulation of the conditions that are experienced (McMillan & Schumacher, 2006).

3.2 Approach

The approach is to use unit costs per learner as a proxy for equality of school resource distribution. The unit costs are calculated by dividing the specific expenditure of a school (personnel and other recurrent costs) by the total number of learners at this school. These are the actual average unit costs of this school. This model uses a definition of unit costs from Mingat & Tan (2003) which divides aggregate spending at a school level by the number of learners.

The school-specific costs in this study are defined as:

- The recurrent annual costs of schooling financed by the state government. These are mainly personnel costs for teachers and other recurrent costs (eg. learning materials, teacher training).
- Because of the shared responsibilities between the state and the districts in the education sec-

[10] The KDW is the Hessian Education Management Information System (EMIS). It is a relational database system and mainly contains data about schools, learners, teachers and classes. It is the central source for the school statistics and is primarily fed by the yearly electronically school survey.

tor of Hesse the expenditure of the districts will not be considered in the study. These are the costs of the school infrastructure, the costs of the school secretariat (personnel and non-personnel-costs), the costs of teaching material and the costs of the facility management.

- Capital costs as well as capital investments, opportunity costs and direct private costs will also not be examined.
- Depreciation and accrued liabilities (eg. for pensions and sickness cover) will not be computed because of conceptual calculation problems in the beginning of the accrual accounting approach in Hesse.
- The accounting data of the fiscal years 2008 and 2009 will be assessed to detect possible trends. The time series data will be adjusted for inflation, with 2008 as the base year.

The number of learners for calculating the unit costs for a school is defined in the study as the sum of learners enrolled in the grades 1 to 4. Because of the differences between the fiscal (01.01.-31.12.) and schooling year (01.08.-31.07.) and to get congruent data, an average number of learners is used as the calculation basis for the unit costs. The established human capital management system (SAP HCM) and the accrual accounting system (SAP ERP) make it possible to analyse the specific costs of a school because payroll and accounting data are directly booked to school-specific accounting objects. The actual personnel costs of a school are first booked from the payroll accounting to the cost centre of each school. The personnel costs are distributed on basis of the teaching hours per school type and grade to the cost objects of a school. All similar cost objects are aggregated later on to state wide output oriented products (e.g. “education in primary schools”). Other recurrent costs are booked directly to the cost objects of a school that caused the costs. If a direct cost assignment is not possible other recurrent costs are booked in the same way as personnel costs (distribution over the cost centre to the cost objects on the basis of teaching hours).

The data source of the essential cost assignment from the cost centre to the cost objects (mainly school type and grade) is the Kultus Data Warehouse (KDW). The data in the KDW is based on the data entry of the schools. Unfortunately there are school heads that do not fill in the database accurately and do

not understand the administrative need to do so. The major problems exist with the data entry of teaching hours for the support of handicapped and migrant learners (not for general teaching). The data for the number of learners and the number of teachers is mostly correct. But as long as there are no penalties for inaccurate data or the omission of data, problems with data reliability and the analysis of school data will exist.

To observe variations in the resource allocation based on school size, gender, nationality, special needs, class size, district, urbanisation, social status and learner achievement particular data is provided in the dataset of every school.

The recently developed Socialindex per school is used in Hesse to analyse correlations between school resources and the social status of the school. The Hessian Socialindex includes the following indicators from the database of the statistical office: income per taxpayer (district level), proportion of unemployed residents (district level), proportion of residents with social welfare (district level), proportion of residents with foreign nationality (school level), proportion of flats in single-family houses (district level), proportion of residents employed with at least “Abitur” (university-entrance diploma; district level), proportion of residents employed (district level). The Socialindex measures the situation of the social environment of a school by standardization of the social indicators at the average level of Hesse with value zero. Negative values are social burdens while positive values are advantages compared with the Hessian average. The different weights of the social indicators in the index are based on the strength of the correlations between the social indicators and the indicators for learner achievement (mainly results of state wide tests / exams). The Socialindex per school averages the indicator values of all learners at this school.

To examine correlations between resources and learner achievement the mean test score per primary school in the Reading Competency Test at the end of grade 2 is used.

3.3 Case Criteria

The broader context of the study is equality in education resource allocation in Germany. To narrow the view, one federal state - namely Hesse – is observed. In the education sector of Hesse the focus is reduced by choosing only the primary public schools. To get a clear base of data, the pure primary schools without combination of other school types are assessed.

3.4 Data Collection

Special data collection for the study is not necessary because all relevant data is available in the existing data systems of the Ministry of Education Hesse. Therefore the study is a secondary data analysis. For each pure primary school (quantity ca. 940 schools) the following dataset will be considered:

1. School-ID
2. Number of learners enrolled in grade 1-4 (definition see 3.2)
3. Number of female learners enrolled in grade 1-4
4. Number of learners with migration backgrounds / foreign nationality enrolled in grade 1-4 (criterion: foreign nationality identity card)
5. Number of learners with special needs enrolled in grade 1-4
6. Average class size
7. District
8. Socialindex (description see 3.2)
9. Mean Test Score in the Reading Competency Test at the end of grade 2 (description see 3.2)
10. District population
11. District population density (urbanisation)[11]
12. Personnel state costs per year (definition see 3.2)
13. Other recurrent state costs per year (definition see 3.2)

[11] For definition see: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Population_density; last viewed 19.11.2010

The sources for the data are given by the Kultus Data Warehouse (KDW; points 1-9 above), the Statistical Office Hesse (points 10-11 above) and the Hessian accounting system (points 12-13 above).
The responsible EMIS unit of the Ministry of Education Hesse provided the data for the study from the KDW. The data about the district population density is available from the website of the Statistical Office Hesse. It is based on the official yearly population reports of the districts to the Statistical Office and the square kilometres district area. In the Hessian accounting system (SAP ERP) the costs of every school in Hesse is accessible. It is an accrual accounting system with options for cost centre and cost objective analyses. The personnel costs in the accounting system result from the integrated human resources management system (SAP HCM) that also generates the payroll.
To detect potential trends cost data of two years should be analysed (2008, 2009). The accounting unit for the school sector in the Ministry of Education Hesse made the cost data for the study available.
To match the cost data (fiscal year 01.01.-31.12.) with the school data (schooling year 01.08.-31.07.) a weighted average of learners will be calculated. The learner numbers of the school years 2007/2008, 2008/2009 and 2009/2010 are used. All data used is aggregated to school level (exception: district level for urbanisation), is not personal and therefore anonymous.

3.5 Data Analysis

As described above the unit costs per learner based on real expenditure data are assessed as a proxy for resource allocation equality. The approach of the study is to understand variations in unit costs by school size, urbanisation, gender, migration status, special needs status, class size, social status and learner achievement of the pure primary schools.

The following statistical key indicators for the unit cost data (personnel and other recurrent costs separately) at a school level should be calculated:

Mean / Average[12]

The sum of a list of numbers, divided by the number of numbers.

Standard deviation[13]

The most widely used measure of dispersion of a frequency distribution introduced by K. Pearson (1893). It is equal to the positive square root of the variance.

Minimum / Maximum

In statistics the Minimum is the smallest observation (least value) of a dataset. The Maximum is the largest observation (greatest value).

Percentiles[14]

The set of partition values which divide the total frequency into one hundred equal parts. This particular set of values is most used in education and psychology. In this study the 10^{th} and the 90^{th} percentiles should be observed.

Median[15]

The median is that value which divides the total frequency into two halves.

[12] Source of definition: http://statistics.berkeley.edu/~stark/SticiGui/Text/gloss.htm#mean; last viewed 19.11.2010

[13] Source of definition: http://stats.oecd.org/glossary/; last viewed 19.11.2010

[14] Source of definition: http://stats.oecd.org/glossary/; last viewed 19.11.2010

[15] Source of definition: http://stats.oecd.org/glossary/; last viewed 19.11.2010

Further the bivariate correlations between the total unit costs and the school variables school size, urbanisation, gender, immigration, special needs, class size, social index and learner results should be observed and ranked regarding their cost-influence.

To analyse broader patterns in cost dependency the following mean values will also be calculated:

- Average costs per school size range: In Hesse ranges for school sizes are defined because of the different head teacher payment. The ranges are as follows:
    - Less than 80 learners
    - 81 to 180 learners
    - 181 to 360 learners
    - 361 to 540 learners
    - More than 540 learners
- Average costs per district
- Average costs per district size range: To analyse the influence of the district size to the unit costs per learner the following size ranges should be used:
    - Less than 100.000 inhabitants
    - 100.000-149.999 inhabitants
    - 150.000-199.999 inhabitants
    - 200.000-249.999 inhabitants
    - 250.000-299.999 inhabitants
    - 300.000 or more inhabitants

The study will not address the issues of equality in learner results and socio-economic equality. Furthermore it will not try and identify reasons for inequalities as well as it will not offer solutions to overcome these problems.

3.6 Reliability and Validity

The data that is used for this study is real data of the school system in Hesse. The statistical school data (see 3.4 / 1.-11.) as well as the cost data (see 3.4 / 12.-13.) are real datasets and not estimates based on budget figures. In addition, the dataset is not a sample, but the full population of pure primary schools in Hesse (described under 3.4). All proposed analyses of the study could also be replicated by an external person on basis of the dataset.

The study shows that there are fundamental problems with the cost data for the additional support of handicapped learners and learners with migration backgrounds. They are caused by an assignment problem with the new cost accounting system because the database for the years 2008 and 2009 were the first attempts of book keeping in product structures. The database for the cost accounting regarding support for handicapped learners and migrants out of the yearly IT-based school survey is mostly not properly filled in at the school level. As a simplification the costs are distributed with the same amount to every school with a cost object for support of handicapped learners / migrants irrespective of whether there is in fact support for or there are really learners of this kind (if real school level data is missing). Meetings with experts of the MoE Hesse confirm this issue.

But the main focus of the study namely the funds for general teaching are not concerned with this assignment problem. And the limitations have in principle no impact on the assessment of equality regarding resource allocation in the Hessian school system because the data for the additional support of handicapped learners and learners with migration backgrounds is still accurate enough to show trends.

4. Analysis of the Data

The first step in the analysis is to look into the unit cost data of the general teaching to get a broad overview of the distribution of average unit costs (U). The next research step is to explore bivariate correlations between the average unit costs of the general teaching and the school variables (school size, urbanisation, gender, immigration, special needs, class size, social index and learner results) to get a better understanding of the coherencies at school level. Analysis of the effects of school sizes on unit costs is done by examining school size classes and their corresponding average unit costs of general teaching. The assessment of average unit costs of general teaching at a district level and for district size classes will follow to get an understanding of urbanisation influences on the resource distribution. Additional to the analyses of the resources for general teaching, the average unit costs for special support of handicapped learners (GU) and the average unit costs for learners with migration backgrounds / foreign nationality (MIG) are examined. Though not the core of this study, an analysis of the correlations between the school variables closes the research outline.

Analysis of average unit costs for general teaching

The general teaching in the pure primary schools includes grades 1 to 4. Not included are pre school activities and additional support e.g. for handicapped learners or learners with migration backgrounds / foreign nationality. These resources are separately allocated and accounted for and will be analysed in later sections.

All cost values of 2009 in this study are inflation adjusted with a factor of 0,1% (base year 2008)[16].

The simple average total unit costs (U) for general teaching in 2008 were 2.082 € and 2.164 € in 2009 (see table 2).

[16] Source: http://www.statistik-hessen.de/themenauswahl/preise/landesdaten/verbraucherpreisindex-in-hessen-und-deutschland/index.html; last viewed 07.12.2010

Table 2: Analysis of average unit costs for general teaching

Values in €	Unit cost U PC 2008	Unit cost U ORC 2008	Unit cost U total 2008	Unit cost U-PC 2009	Change prev year %	Unit cost U-ORC 2009	Change prev year %	Unit cost U-total 2009	Change prev year %
Average	2.051	31	2.082	2.129	3,8	36	14,9	2.164	4,0
Standard deviation	481	14	483	483	0,5	16	13,7	486	0,6
Minimum	700	3	711	826	17,9	6	93,2	854	20,1
10th percentile	1.510	19	1.540	1.564	3,6	22	16,8	1.595	3,6
Median	2.008	28	2.041	2.083	3,7	32	14,7	2.123	4,0
90th percentile	2.621	45	2.648	2.731	4,2	52	14,7	2.773	4,7
Maximum	4.734	159	4.785	4.497	-5,0	171	7,48	4.532	-5,3

U-PC = Personnel Costs for general teaching

U-ORC = Other Recurrent Costs for general teaching

There was an increase in the average unit costs for general teaching (after adjustment for inflation) of 4,0% from 2008 to 2009. The whole education budget increased from 2008 to 2009 with 4,67% (before adjustment for inflation). The Standard deviation was about 483 € (2008) respectively 486 € (2009). Schools in the 10th percentile received about 1.108 € (2008: 1.540 € vs. 2.648 €) respectively 1.178 € (2009: 1.595 € vs. 2.773 €) less costs per learner as schools in the 90th percentile. The 10th percentile value increased from 2008 to 2009 with 3,6% while the 90th percentile value grew with 4,7%.

Experts of the Ministry of Education Hesse argued that average unit costs under 1.400 € and over 3.000 € are exceptional according to the distribution formula for general teaching. But the values could nevertheless occur because of the redistribution of resources for general teaching on level of the regional state education offices or assignment problems in the accounting system. In the judgement of the experts the database is accuracy, valid and appropriate for the study.

The findings described above for the average total unit costs are also valid for the personnel fraction (PC = personnel costs) of the unit costs which accounts for about 98,5% of the unit costs. The other recurrent costs (ORC) increased mostly with more than 10% from 2008 to 2009 but only accounts for less than 1,5% of the total unit costs and are therefore not really meaningful.

The weighted average total unit costs for general teaching were a little bit higher than the simple average total unit costs for general teaching (2008: 2.090 € to 2.082 € / 2009: 2.171 € to 2.164 €). This is only a small variation on state level (see table 3).

Table 3: Analysis of weighted average total unit costs for general teaching state level

Values in €	Weighted uc	Simple uc	€-Variance weighted to simple uc	%-Variance weighted to simple uc
2008	2.090	2.082	7,88	0,4
2009	2.171	2.164	6,28	0,3

The analysis described above shows that the Hessian resource allocation for general teaching to pure primary schools in the years 2008 and 2009 is not equal on basis of unit costs for general teaching at the school level.

Analysis of correlations between average total unit costs for general teaching and school variables

In this study the following school variables could be used to better comprehend the school level situation:

Table 4: School variables overview[17]

School variables 2008	Total no.	Average	Standard deviation	Minimum	10th percentile	Median	90th percentile	Maximum
School size (no. of pupils)	177.952,7	188,1	104,4	14,3	65,2	171,3	336,3	668,0
Social status (social index)	n.a.	13,3	64,1	-215,6	-81,7	24,0	84,7	159,0
Learner achievement (test score)	n.a.	82,7	6,1	56,0	74,7	83,4	89,6	97,8
Avg class size	n.a.	20,0	2,8	6,1	16,6	20,3	23,0	50,5
Gender (no. of pupils)	87.126,7	92,1	51,7	7,3	30,8	84,5	164,8	332,0
Foreign nationality/migration (no. of pupils)	20.875,5	22,1	31,2	0,0	0,0	8,8	58,9	231,8
Special needs status (no. of pupils)	1.308,3	1,4	3,1	0,0	0,0	0,0	3,8	26,3
%FEM	n.a.	48,9	4,3	33,2	43,8	48,9	54,1	64,8
%MIG	n.a.	9,2	10,6	0,0	0,0	5,3	23,7	73,3
%Handicapped	n.a.	0,7	1,3	0,0	0,0	0,0	2,2	10,8
School variables 2009	**Total no.**	**Average**	**Standard deviation**	**Minimum**	**10th percentile**	**Median**	**90th percentile**	**Maximum**
School size (no. of pupils)	173.144,1	183,0	102,4	16,8	62,0	168,3	329,3	652,3
Social status (social index)	n.a.	13,3	64,1	-215,6	-81,7	24,0	84,7	159,0
Learner achievement (test score)	n.a.	82,7	6,1	56,0	74,7	83,4	89,6	97,8
Avg class size	n.a.	19,6	2,6	7,0	16,3	19,9	22,6	25,0
Gender (no. of pupils)	84.662,9	89,5	50,7	7,6	29,9	82,2	161,6	327,8
Foreign nationality/migration (no. of pupils)	16.876,3	17,8	25,3	0,0	0,0	7,4	47,6	202,0
Special needs status (no. of pupils)	1.447,8	1,5	3,3	0,0	0,0	0,0	4,4	29,3
%FEM	n.a.	48,8	4,2	31,2	43,6	48,8	53,9	65,8
%MIG	n.a.	7,6	8,6	0,0	0,0	4,6	18,8	67,5
%Handicapped	n.a.	0,8	1,4	0,0	0,0	0,0	2,4	10,9

To get a better understanding of the coherencies at the school level the bivariate correlations between

[17] The term “pupils” is in tables and graphs used synonymous to “learners”.

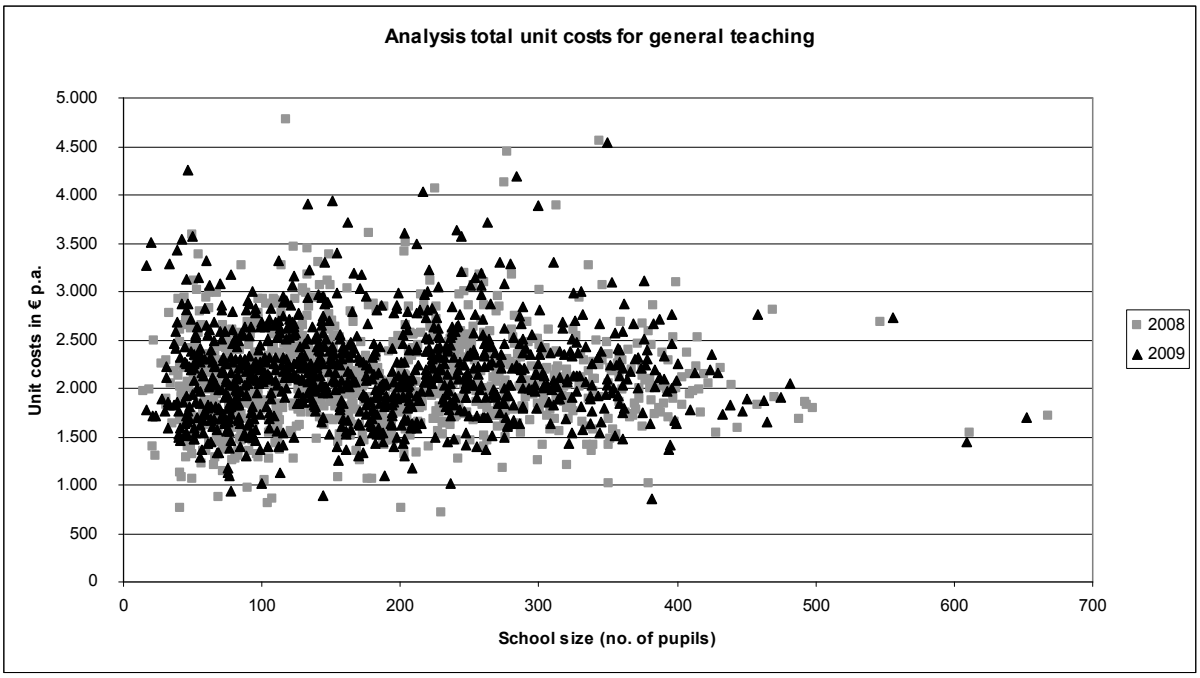
the simple total average unit costs for general teaching and school specific variables are observed:

Table 5: Analysis of correlations between simple average total unit costs for general teaching and school variables

Bivariate correlation coefficients	Unit cost U-total 2008	Unit cost U-total 2009
School size (no. of pupils)	0,029	0,023
Social status (social index)	-0,191	-0,173
Learner achievement (test score)	-0,139	-0,165
Avg class size	-0,226	-0,246
%MIG	0,210	0,199
%FEM	0,019	0,007
%Handicapped	0,342	0,344

Table 5 shows no significant correlations between school size (no. of learners) as well as proportion of female learners (%FEM) and total average unit costs for general teaching in 2008 and 2009.

The following scatter graph of the simple average total unit costs for general teaching and school size (see graph 1) also points out that there is no meaningful relationship between unit costs and school size:



Graph 1: Analysis of simple average unit costs for general teaching and school size

The highest correlation coefficient of 0,34 (2008 and 2009) exists between proportion of learners with

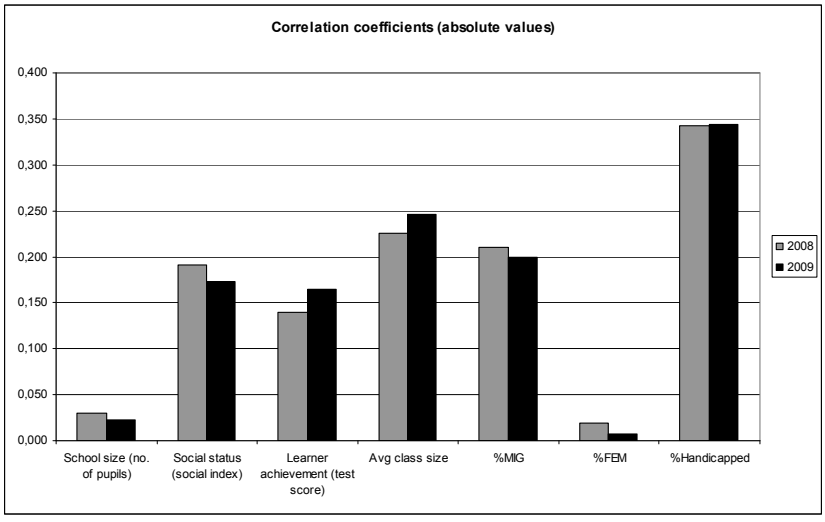
special needs (%Handicapped) and total average unit costs for general teaching. The higher the proportion of handicapped learners are, the higher the unit cost values are. This result is noteworthy because the funding formula for general teaching does not account for handicapped learners in principle. The resources to support handicapped learners are allocated separately (see analysis of unit costs GU). On the one hand this could be an assignment problem in the accounting system. On the other hand districts / schools could shift their resource endowment for general teaching to underpin the support of handicapped learners in terms of inclusive teaching. There are also positive correlations between the proportion of learners with migration backgrounds (%MIG) and the average total unit costs (0,21 in 2008, 0,199 in 2009). This finding is the same as the result for the handicapped learners above. The general funding formula does also NOT consider migrant learners in principle. The support for migrant learners is separately funded (see analysis of unit costs MIG). This also could be reasoned by an assignment problem in the accounting system or a resource shift on district / school level to the support of migrant learners. The social status of a school (-0,191 in 2008 / -0,173 in 2009) and the learner achievement (-0,139 in 2008 / -0,165 in 2009) correlate negative with the average total unit costs. The higher the social status / learner achievement is the lower the total unit cost values are. But actually the allocation formula for the general teaching also not accounts for the support of lower social status and lower learner results. Maybe districts / schools create smaller classes for learners with lower social status or learning difficulties or give additional teaching hours to these learner groups out of the general teaching amount. An assignment problem in the accounting system also could be possible. The average class size is of course negative correlated with the total average unit costs (-0,23 in 2008 / -0,25 in 2009). A higher average class size leads to a lower average total unit cost value. The analysis of the correlations for average personnel and other recurrent costs (ORC) per learner shows that - with one exception (ORC for special needs 2009) - the other recurrent unit costs have almost nonexistent correlations with the based statistical key indicators (correlation coefficients from 0,0 to 0,089; see table 6).

Table 6: Analysis of correlations between average personnel and other recurrent unit costs for general teaching and school variables

Bivariate correlation coefficients	Unit cost per pupil U-PC 2008	Unit cost per pupil U-ORC 2008	Unit cost per pupil U-PC 2009	Unit cost per pupil U-ORC 2009
School size (no. of pupils)	0,029	0,036	0,020	0,086
Social status (social index)	-0,191	-0,016	-0,173	-0,019
Learner achievement (test score)	-0,140	0,005	-0,165	-0,029
Avg class size	-0,226	-0,034	-0,248	0,012
%MIG	0,211	0,008	0,199	0,047
%FEM	0,019	0,009	0,006	0,022
%Handicapped	0,343	0,038	0,342	0,110

Only the ORC 2009 are higher correlated with the proportion of handicapped learners (%Handicapped; correlation coefficient of 0,135 / 0,110). Possibly schools used their budget for ORC exceeded to support handicapped learners or an assignment problem is in the accounting system. The average personnel unit costs are similar correlated as the average total unit costs with the based statistical key indicators.

The following graph (see graph 2) shows the grade of influence of school variables to the average total unit costs for general teaching regarding their absolute correlation coefficients:



Graph 2: Analysis of correlations between average total unit costs for general teaching and school variables (correlation coefficients abs. values)

Analysis of average total unit costs for general teaching by school size classes

Although correlations between school size (no. of learners) and total average unit costs for general teaching are not really significant, a look into specifics regarding school sizes is interesting from a political point of view. The concern is caused by the responsibilities of districts for the local school development (local school structure as well as the establishment of schools) while the teachers are paid by the state. So the following step in the analysis process is to examine school size classes and their corresponding average unit costs of general teaching. The analysis is oriented at the school size classes of chapter 3.5:

Table 7: School size classes

	No. of pupils	
School size class	Min	Max
1		80
2	81	180
3	181	360
4	361	540
5	541	

The number of pure primary schools in the study differentiated by school size classes is showed in the following table:

Table 8: Number of schools per school size class

No. of schools per school size class	
1	169
2	334
3	388
4	52
5	3
Sum	946

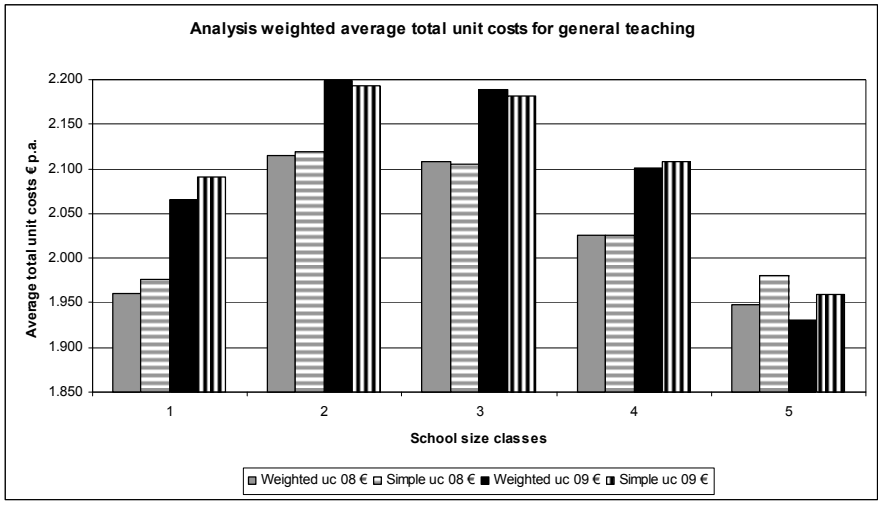
As table 8 shows most of the schools (388 schools) were in the school size class 3 (181 to 360 learners), followed by size class 2 (81 to 180 learners) with 334 schools and class 1 with 169 schools (less than 81 learners). The school size class with the largest schools (more than 540 learners) had the lowest school number (3 schools).

The analysis of the school size classes with the weighted average total unit costs for general teaching in principle shows that in both years the school size class 2 (81 to under 180 learners) got the highest total unit costs per learner (2.116 € in 2008 / 2.198 € in 2009). Related to the school size class 5 (over 540 learners) with the mostly lowest unit cost values (1.947 € in 2008 / 1.930 € in 2009), the school size class 2 received about 168 € in 2008 / 268 € in 2009 more average total unit costs for general teaching (see table 9).

Table 9: Analysis of weighted average total unit costs for general teaching regarding school size classes

Schoolsize class	No. of pupils 08	Cost sum U 08 €	Weighted uc 08 €	€-Variance to min value	%-Variance to min value	Simple uc 08 €	€-Variance weighted to simple uc	%-Variance weighted to simple uc
1	10.202	19.999.272	1.960	13	0,7	1.976	-15	-0,8
2	43.795	92.651.393	2.116	168	8,6	2.119	-3	-0,2
3	101.013	212.961.667	2.108	161	8,3	2.105	3	0,1
4	21.116	42.762.255	2.025	78	4,0	2.026	-1	-0,1
5	1.826	3.555.358	1.947	0	0,0	1.980	-33	-1,7
Schoolsize class	**No. of pupils 09**	**Cost sum U 09 €**	**Weighted uc 09 €**	**€-Variance to min value**	**%-Variance to min value**	**Simple uc 09 €**	**€-Variance weighted to simple uc**	**%-Variance weighted to simple uc**
1	9.788	20.219.655	2.066	136	7,0	2.091	-25	-1,2
2	42.290	92.960.671	2.198	268	13,9	2.193	5	0,2
3	98.588	215.761.115	2.189	258	13,4	2.181	7	0,3
4	20.661	43.401.546	2.101	170	8,8	2.107	-7	-0,3
5	1.817	3.506.455	1.930	0	0,0	1.959	-29	-1,5

The analysis of the school size classes generally states that there is an unequal distribution of the average total unit costs. The highest total unit costs received schools in size class 2 (2.198 € in 2009), followed by class 3 (2.189 € in 2009) and class 4 / 1 (2.101 € / 2.066 € in 2009). The lowest average total unit costs got the large schools in class 5 with only 1.930 € per learner (see graph 3).



Graph 3: Analysis of weighted average total unit costs for general teaching regarding school size classes

Possible reasons for these findings are the facts that the allocation formula for the general teaching is based on reference class sizes (28 learners) and a minimum class size of 13 learners as well as the principle of always rounding up the class numbers to build.

The actual resource allocation regarding the average total unit costs for general teaching is influenced by school sizes (middle schools get more resources / small as well as large schools get less resources) and is so far not equitable. But the significance of the findings are limited due to the weak correlation between average total unit costs and school size as well as the school size class 5 only covers three schools.

Analysis of average total unit costs for general teaching by district and district size classes

The assessment of average unit costs for general teaching at the district level and for district size classes provides a basis to get an understanding for urbanisation influences to the resource distribution. The average total unit costs for general teaching vary by district[18]. The range of the simple average unit costs started in 2008 with 1.764 € in district Offenbach and ended with 2.413 € in Schwalm-Eder district, also a variation of 650 € or 36,8% (see table 10).

Table 10: Simple average total unit costs for general teaching 2008 per district

District	Avg total unit costs U 08 (sorted min to max)	€-Variance to min value	%-Variance to min value
OFL	1.764	0	0
RTK	1.821	57	3,2
DADI	1.877	113	6,4
BS	1.907	144	8,1
GG	1.922	159	9,0
MTK	1.947	184	10,4
MR	1.991	228	12,9
KSL	1.996	233	13,2
VB	2.014	250	14,2
F	2.016	252	14,3
LM	2.018	254	14,4
OFS	2.025	261	14,8
MKK	2.039	276	15,6
HR	2.058	294	16,7
WF	2.080	317	18,0
WI	2.083	319	18,1
DA	2.134	371	21,0
FD	2.146	383	21,7
WK	2.173	410	23,2
GI	2.266	502	28,5
LDK	2.315	551	31,3
KSS	2.316	552	31,3
OWK	2.323	560	31,7
HTK	2.345	582	33,0
WM	2.386	622	35,3
SEK	2.413	650	36,8

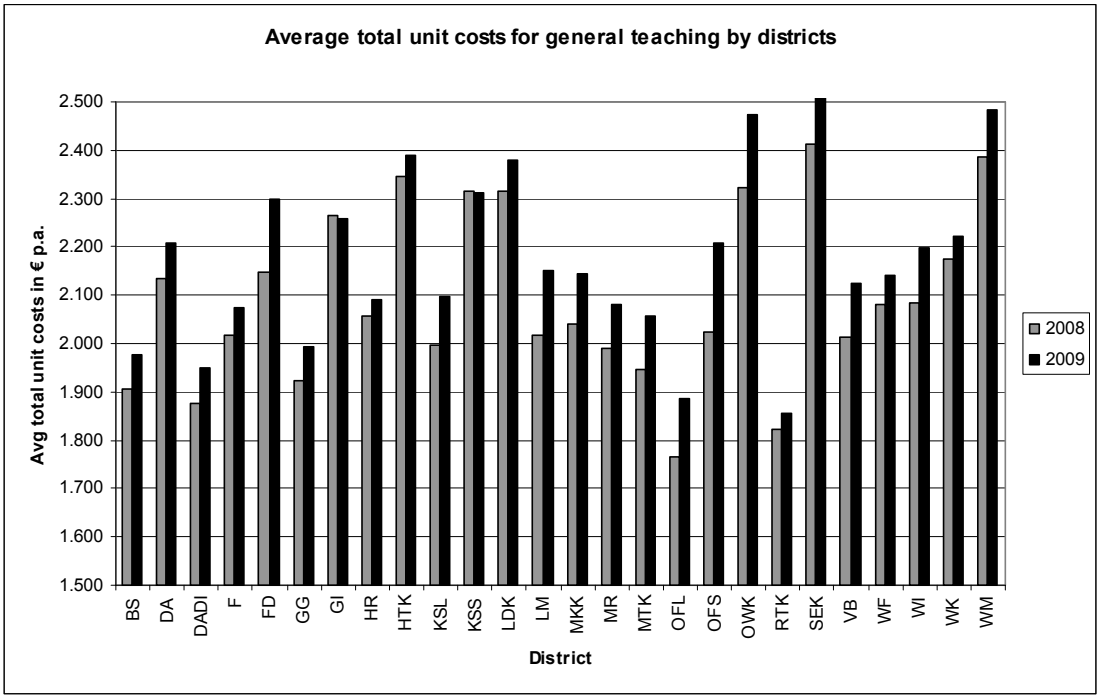
In 2009 the spread led from 1.855 € in Rheingau-Taunus district to 2.522 € also in Schwalm-Eder district (difference 666 € / 35,9%; see table 11).

[18] For additional informations (e.g. name, population, square km) about the districts see appendix 1.

Table 11: Simple average total unit costs for general teaching 2009 per district and variation to 2008

District	Avg total unit costs U 09 (sorted min to max)	€-Variance to min value	%-Variance to min value	Avg total unit costs U 08	€-Variance to 2008 value	%-Variance to 2008 value
RTK	1.855	0	0	1.821	35	1,9
OFL	1.886	31	1,7	1.764	123	7,0
DADI	1.949	94	5,0	1.877	72	3,9
BS	1.978	122	6,6	1.907	70	3,7
GG	1.992	137	7,4	1.922	70	3,7
MTK	2.057	202	10,9	1.947	110	5,7
F	2.075	220	11,8	2.016	60	3,0
MR	2.081	225	12,1	1.991	89	4,5
HR	2.089	234	12,6	2.058	31	1,5
KSL	2.099	243	13,1	1.996	103	5,1
VB	2.124	269	14,5	2.014	110	5,5
WF	2.140	284	15,3	2.080	60	2,9
MKK	2.144	288	15,5	2.039	104	5,1
LM	2.152	296	16,0	2.018	134	6,6
WI	2.198	343	18,5	2.083	115	5,5
DA	2.207	351	18,9	2.134	73	3,4
OFS	2.208	352	19,0	2.025	183	9,0
WK	2.221	365	19,7	2.173	47	2,2
GI	2.260	404	21,8	2.266	-6	-0,3
FD	2.299	443	23,9	2.146	153	7,1
KSS	2.313	458	24,7	2.316	-2	-0,1
LDK	2.378	522	28,1	2.315	63	2,7
HTK	2.389	534	28,8	2.345	44	1,9
OWK	2.472	617	33,3	2.323	149	6,4
WM	2.482	627	33,8	2.386	96	4,0
SEK	2.522	666	35,9	2.413	109	4,5

The variations between 2008 and 2009 were -6 € (-0,3%) in the district of Gießen up to 183 € (9,0%) in the city of Offenbach. The following graph shows the different average total unit cost values for both years by districts:



Graph 4: Analysis of simple average total unit costs for general teaching by districts

To be aware of patterns in resource allocation regarding districts and their population sizes an analysis of district size classes is useful. Originally the district size classes of the United Nations Statistics Division[19] should be used for the analysis of the district population sizes and their corresponding unit costs. But the classification is not meaningful for Hesse because the most of the Hessian districts are in the second highest class (100.000 - 499.000 inhabitants). So an alternative classification was used to segregate districts more and take into account the situation of Hesse (see chapter 3.5). The table below states the number of Hessian districts in the different district size classes:

Table 12: District size classes and number of Hessian districts in the different district size classes

District population size	Class#	No. of districts in Hesse
Less than 100.000	1	1
100.000-149.999	2	5
150.000-199.999	3	5
200.000-249.999	4	4
250.000-299.999	5	8
300.000 or more	6	3
Sum		26

The analysis of the average total unit costs for general teaching in dependency of district size classes shows that in tendency districts with higher population values have lower per learner unit costs (2008: lowest population class 1 = 2.323 €, highest class 5 = 1.939 €; 2009: class1 = 2.472 €, class 5 = 2.035 €; see table 13).

Table 13: District size classes and corresponding simple average total unit costs for general teaching

District size class	Avg total unit costs 2008	Avg total unit costs 2009
1	2.323	2.472
2	2.123	2.222
3	2.130	2.196
4	2.109	2.211
5	2.067	2.132
6	1.939	2.035

To get a better look inside of the association between districts and average total unit costs for general teaching several bivariate correlations are calculated (see table 14).

[19] See: http://unstats.un.org/unsd/demographic/sconcerns/densurb/densurbmethods.htm; last viewed 07.12.2010

Table 14: Analysis of correlations between simple average total unit costs for general teaching, school variables and district data

Correlation between	Correlation coefficient
No. of pupils per district and avg total unit costs U 08	-0,343
No. of pupils per district and avg total unit costs U 09	-0,390
District population and avg total unit costs U 08	-0,276
District population and avg total unit costs U 09	-0,323
District square km and avg total unit costs U 08	0,156
District square km and avg total unit costs U 09	0,157
District size class and avg total unit costs U 08	-0,353
District size class and avg total unit costs U 09	-0,406
District population density and avg total unit costs U 08	-0,127
District population density and avg total unit costs U 09	-0,105
District population and avg class size 09	0,380
District population and avg class size 09	0,337
District population density and avg class size 08	0,641
District population density and avg class size 09	0,673
District population density and avg %MIG 08	0,926
District population density and avg %MIG 09	0,930

The correlation between simple average total unit costs for general teaching and the district population draws the same picture as the analysis of the district size classes (correlation coefficient of -0,276 in 2008 and -0,323 in 2009) above. The results of the correlation of the simple average total unit costs for general teaching and the district size classes have a slightly higher correlation coefficients of -0,353 (2008) and -0,406 (2009). There is also a low association between simple average total unit costs for general teaching and the district population density with a correlation coefficient of -0,127 (2008) and -0,105 (2009). The correlation between simple average total unit costs for general teaching and square kilometres of district area also shows, although witha low correlation coefficient of 0,156 (2008) / 0,157 (2009) a trend that larger districts have higher per learner unit costs. The correlation coefficient between simple average total unit costs for general teaching and the number of learners in the district are -0,343 (2008) and -0,390 (2009). The more learners are in a district the lower the average unit costs for general teaching per learner are. There is also a significant positive correlation between the district population and the average class size (correlation coefficient 0,380 in 2008, 0,337 in 2009) as well as between class size and district population density (correlation coefficient 0,641 in 2008, 0,673 in 2009). This means that the more people are in a district / the higher the population density, the higher the average class size is. The district population density and the proportion of learners with migration backgrounds are high correlated (correlation coefficient 0,926 in 2008, 0,930 in 2009). The

finding is that in urban areas more migrant learners are. The weighted average total unit costs for general teaching on district level were different to the simple average (see table 15). The highest change in the ranking of the total unit costs (sorted min to max) were the districts Marburg (improvement of 11 ranks; 2.214 € weighted unit costs to 1.991 € simple unit costs), Vogelsberg district (improvement of 7 ranks; 2.153 € to 2.014 €) and the Lahn-Dill district (improvement of 5 ranks; 2.443 € to 2.315 €) compared to the simple total unit costs. On the other hand the districts Kassel (decline of 4 ranks; 1.954 € weighted unit costs to 1.996 € simple unit costs), Main-Kinzig (decline of 3 ranks; 2.062 € to 2.039 €) and the city of Offenbach (decline of 3 ranks; 2.037 € to 2.025 €) slid down.

Table 15: Analysis of weighted average total unit costs for general teaching district level 2008

District	No. of pupils 08	Cost sum U 08 €	Weighted uc 08 € (sorted min to max)	€-Variance to min value	%-Variance to min value	Simple uc 08 €	€-Variance weighted to simple uc	%-Variance weighted to simple uc	Rank weighted uc	Rank simple uc	Variance rank
OFL	10.146	18.045.944	1.779	0	0,0	1.764	15	0,8	26	26	0
RTK	5.202	9.359.693	1.799	21	1,2	1.821	-21	-1,2	25	25	0
DADI	9.313	17.681.651	1.899	120	6,8	1.877	22	1,2	24	24	0
KSL	8.187	15.993.502	1.954	175	9,8	1.996	-43	-2,2	23	19	4
BS	7.423	14.520.394	1.956	177	10,0	1.907	49	2,5	22	23	-1
MTK	8.201	16.074.727	1.960	182	10,2	1.947	13	0,7	21	21	0
GG	9.467	18.608.579	1.966	187	10,5	1.922	44	2,2	20	22	-2
F	15.412	30.428.406	1.974	196	11,0	2.016	-41	-2,1	19	17	2
OFS	3.732	7.600.398	2.037	258	14,5	2.025	12	0,6	18	15	3
MKK	11.242	23.175.492	2.062	283	15,9	2.039	22	1,1	17	14	3
HR	4.053	8.380.861	2.068	289	16,3	2.058	10	0,5	16	13	3
LM	5.053	10.461.269	2.070	292	16,4	2.018	52	2,5	15	16	-1
WF	4.334	9.077.622	2.094	316	17,8	2.080	14	0,7	14	12	2
WI	8.402	17.877.175	2.128	349	19,6	2.083	45	2,1	13	11	2
DA	3.879	8.298.243	2.139	361	20,3	2.134	5	0,2	12	10	2
VB	3.204	6.897.425	2.153	374	21,0	2.014	139	6,4	11	18	-7
FD	7.139	15.639.169	2.191	412	23,2	2.146	45	2,0	10	9	1
MR	6.485	14.355.054	2.214	435	24,5	1.991	222	10,0	9	20	-11
WK	8.155	18.124.150	2.223	444	25,0	2.173	49	2,2	8	8	0
GI	7.664	17.277.355	2.254	476	26,8	2.266	-11	-0,5	7	7	0
KSS	5.483	12.566.031	2.292	513	28,9	2.316	-24	-1,0	6	5	1
HTK	8.226	18.963.030	2.305	527	29,6	2.345	-40	-1,7	5	3	2
OWK	1.698	3.981.453	2.344	566	31,8	2.323	21	0,9	4	4	0
SEK	5.212	12.589.970	2.416	637	35,8	2.413	2	0,1	3	1	2
WM	2.658	6.450.377	2.427	648	36,4	2.386	41	1,7	2	2	0
LDK	7.984	19.501.978	2.443	664	37,3	2.315	128	5,2	1	6	-5

In 2009 there was a similar picture (see table 16). The analysis of the variations between the districts on basis of the weighted average total unit costs for general teaching also shows a wide range. It started in 2008 with 1.779 € in district Offenbach and ended with 2.443 € in Lahn-Dill district, also a variation of 664 € or 37,3%. In 2009 the spread led from 1.828 € in Rheingau-Taunus district to 2.546 € also in Lahn-Dill district (difference 718 € / 39,3%).

Table 16: Analysis of weighted average total unit costs for general teaching district level 2009

District	No. of pupils 09	Cost sum U 09 €	Weighted uc 09 € (sorted min to max)	€-Variance to min value	%-Variance to min value	Simple uc 09 €	€-Variance weighted to simple uc	%-Variance weighted to simple uc	Rank weighted uc	Rank simple uc	Variance rank
RTK	5.069	9.262.724	1.828	0	0,0	1.855	-28	-1,5	26	26	0
OFL	9.981	18.908.338	1.894	67	3,7	1.886	8	0,4	25	25	0
DADI	8.984	17.506.464	1.949	121	6,6	1.949	0	0,0	24	24	0
GG	9.182	18.774.331	2.045	217	11,9	1.992	52	2,6	23	22	1
F	15.284	31.255.364	2.045	217	11,9	2.075	-30	-1,5	22	20	2
KSL	7.861	16.195.188	2.060	233	12,7	2.099	-39	-1,9	21	17	4
BS	7.129	14.779.288	2.073	246	13,4	1.978	96	4,6	20	23	-3
MTK	8.188	17.008.139	2.077	250	13,7	2.057	20	1,0	19	21	-2
MKK	10.855	22.887.645	2.108	281	15,4	2.144	-35	-1,7	18	14	4
HR	3.893	8.243.653	2.118	290	15,9	2.089	28	1,3	17	18	-1
WF	4.171	8.958.374	2.148	321	17,5	2.140	8	0,4	16	15	1
DA	3.896	8.602.116	2.208	380	20,8	2.207	1	0,0	15	11	4
OFS	3.825	8.479.116	2.217	389	21,3	2.208	9	0,4	14	10	4
LM	4.834	10.742.604	2.223	395	21,6	2.152	71	3,2	13	13	0
WI	8.284	18.485.028	2.231	404	22,1	2.198	33	1,5	12	12	0
WK	7.844	17.690.510	2.255	428	23,4	2.221	35	1,5	11	9	2
VB	3.010	6.813.653	2.264	436	23,9	2.124	140	6,2	10	16	-6
KSS	5.366	12.210.056	2.275	448	24,5	2.313	-38	-1,7	9	6	3
GI	7.392	16.856.706	2.280	453	24,8	2.260	20	0,9	8	8	0
MR	6.231	14.270.558	2.290	463	25,3	2.081	209	9,1	7	19	-12
FD	6.877	15.944.101	2.319	491	26,9	2.299	20	0,8	6	7	-1
HTK	7.993	18.977.453	2.374	547	29,9	2.389	-15	-0,6	5	4	1
OWK	1.649	4.064.943	2.465	638	34,9	2.472	-7	-0,3	4	3	1
WM	2.573	6.412.627	2.492	665	36,4	2.482	10	0,4	3	2	1
SEK	5.063	12.885.821	2.545	717	39,3	2.522	23	0,9	2	1	1
LDK	7.713	19.634.642	2.546	718	39,3	2.378	168	6,6	1	5	-4

The assessment of the correlation coefficients shows that the weighted average total unit costs for general teaching enforces the pattern of the simple unit costs results. There is also a negative correlation between the population / the number of learners in a district and the weighted average total unit costs for general teaching as well as a positive correlation with the square kilometres of a district (see table 17).

Table 17: Analysis of correlations between weighted average total unit costs for general teaching and school variables

Correlation between	Correlationcoefficients		
	Weighted uc	Simple uc	Variance abs.
District population density and weighted avg total unit costs U 08	-0,227	-0,127	0,100
District population density and weighted avg total unit costs U 09	-0,202	-0,105	0,097
No. of pupils per district and weighted avg total unit costs U 08	-0,393	-0,343	0,050
No. of pupils per district and weighted avg total unit costs U 09	-0,425	-0,390	0,035
District population and weighted avg total unit costs U 08	-0,321	-0,276	0,045
District population and weighted avg total unit costs U 09	-0,359	-0,323	0,036
District square km and weighted avg total unit costs U 08	0,257	0,156	0,101
District square km and weighted avg total unit costs U 09	0,241	0,157	0,084

The analysis of the weighted average total unit costs for general teaching at a district level confirms the results of the analysis of the simple average total unit costs. It shows that there is a negative relationship between the district population density / district population size / number of learners in a district and the average total unit costs for general teaching: The more people / learners are in a district the lower the per learner unit costs for general teaching are.

The actual Hessian resource allocation to schools is influenced by "urbanisation" (disadvantages for urban areas with high population, advantages for rural areas with less population) and is not equitable.

Analysis of average total unit costs for additional support of handicapped learners and inclusive teaching

Additional to the general teaching resources pure primary schools receive funds for the support of handicapped learners and their inclusive teaching with not handicapped schoolmates (e.g. for additional teaching hours). These are separately allocated according to the number of handicapped learners.
The average total unit costs for additional support for handicapped learners were 37.862 € in 2008 and 34.291 € in 2009. This equated a decrease of about 9,4% (see table 18).

Table 18: Analysis of average total unit costs for additional support of handicapped learners

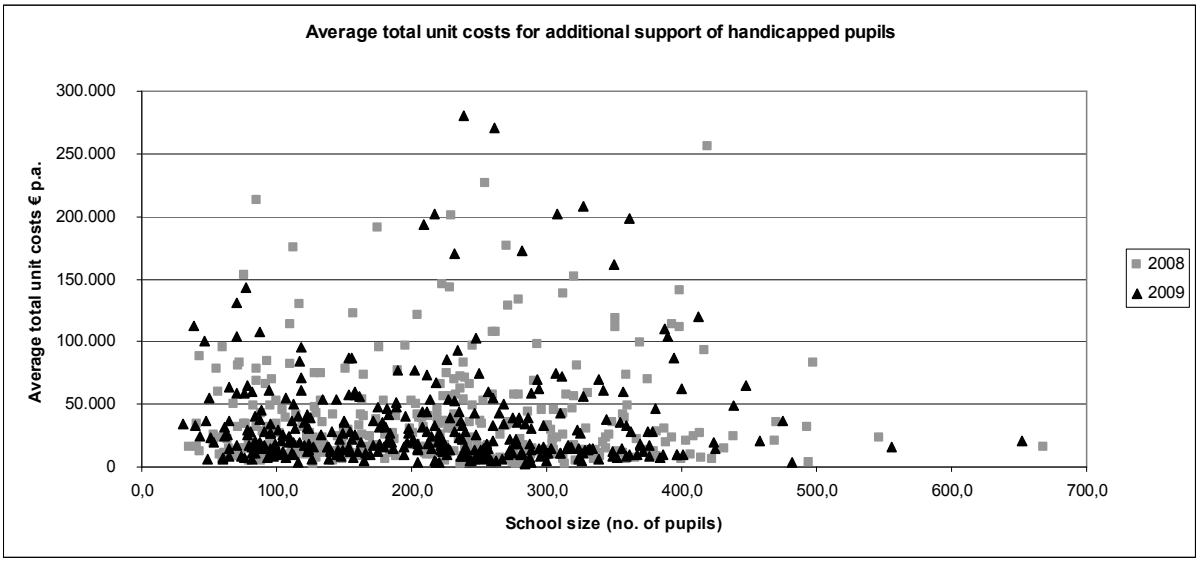
Values in €	Unit cost per pupil GU PC 2008	Unit cost per pupil GU ORC 2008	Unit cost per pupil GU total 2008	Unit cost per pupil GU PC 2009	Change prev year %	Unit cost per pupil GU ORC 2009	Change prev year %	Unit cost per pupil GU total 2009	Change prev year %
Average	37.404	457	37.862	33.814	-9,6	476	4,1	34.291	-9,4
Standard deviation	39.417	507	39.881	38.640	-2,0	562	10,9	39.138	-1,9
Minimum	2.693	25	2.721	3.003	11,5	38	51,4	3.042	11,8
10th percentile	7.950	90	8.039	7.692	-3,2	99	10,1	7.780	-3,2
Median	23.303	273	23.575	19.747	-15,3	284	4,3	19.998	-15,2
90th percentile	82.807	1.014	83.663	69.260	-16,4	1.000	-1,4	70.190	-16,1
Maximum	252.925	3.656	256.178	277.591	9,8	4.902	34,1	279.841	9,2

The Minimum started with 2.721 € (2008) / 3.042 € (2009) and the Maximum ended with 256.178 € (2008) / 279.841 € (2009). The Standard deviation was 39.881 € (2008) / 39.138 € (2009) and shows the broad variability of the distribution. The Median value was 23.575 € in 2008 respectively 19.998 € in 2009. The schools in the 10th percentiles received only 8.039 € (2008) / 7.780 € (2009) per learner on average whereas the schools in the 90th perecentile got 83.663 € (2008) / 70.190 € (2009).
There are almost nonexistent correlations between the average total unit costs for additional support of handicapped learners and school size, social status, learner achievement, class size as well as %FEM and %MIG (see table 19).

Table 19: Analysis of correlations between average total unit costs for additional support of handicapped learners and school variables

Bivariate correlation coefficients	Unit cost per pupil GU total 2008	Unit cost per pupil GU total 2009
School size (no. of pupils)	0,023	0,035
Special needs status (no. of pupils)	-0,418	-0,381
Social status (social index)	-0,048	-0,066
Learner achievement (test score)	-0,008	0,020
Avg class size	0,104	0,069
%FEM	0,046	0,015
%Handicapped	-0,479	-0,436
%MIG	0,000	0,046

The correlation between the special needs status (no. of handicapped learners) as well as the proportion of handicapped learners (%Handicapped) and the average total unit costs for additional support of handicapped learners are significant (-0,418 (2008) / -0,381 (2009) for no. of learners; -0,479 (2008) / -0,436 (2009) for %Handicapped). The analysis shows that a larger number of handicapped learners leads to a lower average of total unit costs for additional support of handicapped learners.



Graph 5: Analysis of average total unit costs for additional support of handicapped learners

Based on the above stated analysis the specific resource allocation in this context is not equitable regarding per learner unit costs. But the average total unit costs for additional support for handicapped learners are very uneven (see also graph 5). This could be caused by an assignment problem (see section 3.6). Meetings with experts of the MoE Hesse confirm this assumption. But the detected trends to inequality are undisputed.

Analysis of average total unit costs for additional support of learners with foreign nationality/migration backgrounds

For the support of learners with migration backgrounds / a foreign nationality schools get also additional funds (see chapter 1.3). The legal basis for the additional funding is stated in the Hessian School Act (§ 3 (13), § 8a)[20]. It states that learners with a native language other than German should be aided so they could be taught with their German schoolmates and could get the same school graduations.
In Hesse the definition of migration is still oriented at the criterion of a foreign nationality identity card. But there are ambitions to change this perspective from the foreign nationality to other criteria (e.g. native language, nationality of parents) because often learners with a German identity card have migration backgrounds and need additional support. The average total unit costs for learners with migration backgrounds were 8.102 € in 2008 and 9.428 € in 2009 respectively. This equated an increase of about 16,4% (see table 20).

[20] See: http://www.hessen.de/irj/HKM_Internet?cid=c1f7ee3ac049d51fa14df6f30a1b156a; unfortunately only in German; last viewed 07.12.2010

Table 20: Analysis of average total unit costs for additional support of learners with migration backgrounds

Values in €	Unit cost per pupil MIG-PC 2008	Unit cost per pupil MIG-ORC 2008	Unit cost per pupil MIG-total 2008	Unit cost per pupil MIG-PC 2009	Change prev year %	Unit cost per pupil MIG-ORC 2009	Change prev year %	Unit cost per pupil MIG-total 2009	Change prev year %
Average	7.995	107	8.102	9.294	16,2	134	25,7	9.428	16,4
Standard deviation	12.484	156	12.625	14.259	14,2	190	21,5	14.434	14,3
Minimum	202	3	215	112	-44,3	2	-48,9	136	-36,8
10th percentile	884	18	912	848	-4,1	20	13,8	871	-4,5
Median	3.257	49	3.307	3.880	19,1	66	32,6	3.956	19,6
90th percentile	20.227	259	20.449	22.678	12,1	327	26,1	22.903	12,0
Maximum	102.172	1.532	102.971	109.515	7,2	1.687	10,1	111.126	7,9

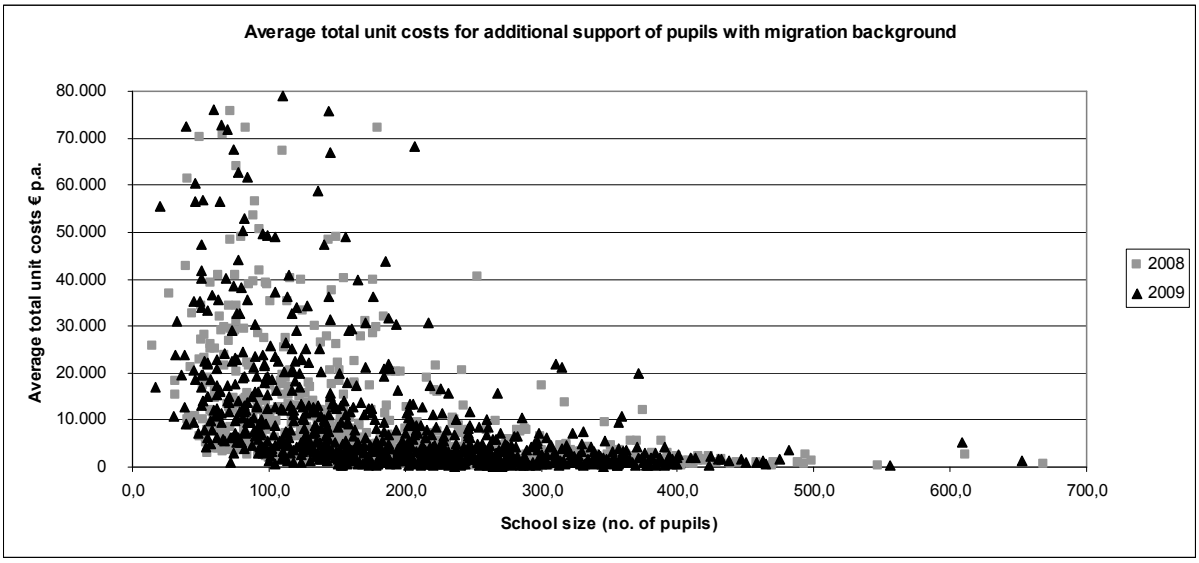
The Minimum started with 215 € (2008) / 136 € (2009) and the Maximum ended with 102.971 € (2008) / 111.126 € (2009). The Standard deviation is 12.625 € (2008) / 14.434 € (2009) and shows the broad variability of the distribution. The Median value was 3.307 € in 2008 respectively 3.956 € in 2009. The schools in the 10th percentiles received only 912 € (2008) / 871 € (2009) per learner on average whereas the schools in the 90th perecentile got 20.449 € (2008) / 22.903 € (2009). While the Minimum (-36,8%) and the 10th percentiles value (-4,5%) decreased, the Maximum (7,9%) and the 90th percentile value (12,0%) increased between 2008 and 2009. There are significant negative correlations (see table 21) between the average total unit costs for learners with migration backgrounds and school size (no. of learners), foreign nationality/migration (no. of migrant learners) as well as average class size. But it is consequentially that more learners (the larger a school, the more migrant learners, the larger the average class size) lead to a lower unit cost value within the actual funding system in Hesse. Also there is a significant negative correlation between the proportion of migrant learners (%MIG) and the average total unit costs for learners with migration backgrounds.

Apparently we have funding disadvantages for larger schools with more learners and schools with a higher proportion of migrant learners.

Table 21: Analysis of correlations between average total unit costs for additional support of learners with migration backgrounds and school variables

Bivariate correlation coefficients	Unit cost per pupil MIG-total 2008	Unit cost per pupil MIG-total 2009
School size (no. of pupils)	-0,433	-0,450
Foreign nationality/migration (no. of pupils)	-0,380	-0,387
Social status (social index)	0,363	0,354
Learner achievement (test score)	0,268	0,296
Avg class size	-0,271	-0,312
%FEM	-0,020	-0,005
%Handicapped	-0,044	-0,034
%MIG	-0,411	-0,423

Significant positive correlations exist between the average total unit costs for learners with migration backgrounds and social status as well as learner achievement. This finding is notable, the higher the total unit costs are, the higher the social status or the test scores are. This implies funding advantages for schools with a higher social status and obviously additional resources for migrants at schools with higher learner achievement. Further no significant correlations between the proportion of female (%FEM) or handicapped learners (%Handicapped) and the average total unit costs for learners with migration backgrounds exist. These school variables have no influence on these total unit costs.



Graph 6: Analysis of average total unit costs for learners with migration backgrounds

Over all the average total unit costs for learners with migration backgrounds are very uneven (see also graph 6). This also could be caused by a problem with the new accounting system (see section 3.6). Meetings with experts of the MoE Hesse confirm this assumption.

But despite the accounting problems the actual resource allocation for migrant learners is nevertheless not equitable on the basis of per learner unit costs.

Analysis of correlations between school variables

Although the analysis of correlations between school variables is not the core of the study, this last research step rounds up the view of the Hessian school system. Table 22 shows the results of the correlations between the school variables that were used in the study. Only significant and notable findings are mentioned below. These have been discussed with experts of the Ministry of Education Hesse and appraised as plausible.

Table 22: Analysis of correlations between school variables

Bivariate correlation coefficients	School size (no. of pupils)	Social status (social index)	Learner achievement (test score)	Avg class size	%MIG	%FEM	%Handicapped
School size (no. of pupils)		-0,372	-0,312	0,655	0,445	0,027	0,087
Social status (social index)	-0,372		0,505	-0,213	-0,761	-0,053	-0,063
Learner achievement (test score)	-0,312	0,505		-0,173	-0,580	0,010	-0,115
Avg class size	0,655	-0,213	-0,173		0,253	0,054	-0,063
%MIG	0,445	-0,761	-0,580	0,253		0,048	0,070
%FEM	0,027	-0,053	0,010	0,054	0,048		-0,012
%Handicapped	0,087	-0,063	-0,115	-0,063	0,070	-0,012	

The average class size is positively correlated with school size and percentage of learners with migrant backgrounds (correlation coefficients 0,655, 0,253). The section of the district analysis shows that the population density and the average class size as well as percentage of learners with migrant backgrounds are correlated positively (correlation coefficients of 0,673, 0,930) and correlated negatively with the average total unit costs for general teaching (-0,20). The combination of the findings suggests that in urban areas larger class sizes, bigger schools, a higher percentage of migrant learners and lower unit costs exist. Furthermore is there a negative correlation between average class size and social status as well as learner achievement (correlation coefficients -0,213, -0,173). It is the assumption that in schools with a higher class size are more learners with lower social status and lower test scores, but the correlation is not very high. The correlation between school size and social status is negative (correlation coefficient -0,372). The assumption in this case is that larger schools have a lower social status. Learner achievement (correlation coefficient 0,505) is positively correlated with the social status (assumption: higher test scores are in schools with higher social status). Between school size (no. of

learners) and proportion of learners with migration backgrounds exits a positive correlation with a correlation coefficient of 0,445 (the larger a school is, the higher the proportion of learners with migration backgrounds is). In combination with the finding that the percentage of migrant learners is highly correlated with the population density (correlation coefficient 0,930; see district analysis section) the assumption is that large schools in urban areas have more migrant learners. The social status and the proportion of learners with migration backgrounds have a negative correlation (correlation coefficient -0,761; the higher the proportion of learners with migration backgrounds is, the lower the social status of a school is). The learner achievement is also negatively correlated with the proportion of migrant learners (correlation coefficient -0,580). The higher the proportion of learners with migration backgrounds is, the lower the learner achievement of a school is.

5. Conclusion

The aim of the study is to assess the equality of the state resource allocation to pure primary public schools in the German state of Hesse on the basis of per learner unit costs and evaluate cost variations as well as correlations with key education indicators (school size, social status, learner achievement, class size, gender, urbanisation, immigration, special needs). The major innovative aspect of the study is the use of real expenditure data at the school level in combination with data about the social status of the learners and learner results in state wide reading tests in Hesse.

The literature review shows that there is no relevant research on equality based on real per learner unit costs at the school level for Germany and Hesse. There is partly evidence for other countries, however this research is based on aggregated expenditure data or on budget allocations and only often allows methodological and theoretical analyses.

On basis of the three standards of equity that Fiske & Ladd (2004; see chapter 2) stated for education systems, Hesse has not yet reached the lowest standard of "equal treatment". In regard to the resource distribution this equity standard points out that everyone should get the same amount of resources irrespective of their personal situation (Fiske & Ladd, 2004).

In detail the research results show that the simple average total unit costs for general teaching were about 2.082 € (2008) / 2.164 € (2009) at the state level. While the schools in the 10th percentile received 1.540 € (2008) respectively 1.595 € (2009) per learner, schools in the 90th percentile got 2.648 € (2008) / 2.773 € (2009). The weighted average total unit costs for general teaching was a little higher than the simple average total unit costs for general teaching (2008: 2.090 € to 2.082 € / 2009: 2.171 € to 2.164 €). This is only a small variation at the state level.

The analysis of correlations between average total unit costs for general teaching and school variables demonstrates that there is an association between the actual resource distribution and school specific variables. The highest correlation coefficient of 0,34 (2008 and 2009) exists between proportion of learners with special needs (%Handicapped) and total average unit costs for general teaching. There are also low positive correlations between the number of learners with migration backgrounds as well

as the proportion of learners with migration backgrounds (%MIG) and the average total unit costs (0,161 / 0,21 in 2008, 0,147 / 0,199 in 2009). These finding are remarkable because in principle the funding formula for general teaching does not take into account handicapped / migrant learners. The resources to support these learners are allocated separately. Possibly this could be an assignment problem in the accounting system or schools shift their resource endowment for general teaching internal to underpin the support of handicapped / migrant learners.

Although the correlations between school size (no. of learners) and total average unit costs for general teaching are not really significant (correlation coefficient 0,02), a look into specifics regarding school sizes is interesting from a political point of view because the districts are responsible for the local school development (local school structure as well as the establishment of schools), but the state pays the teachers.

The analysis of weighted average total unit costs for general teaching by school size classes leads to the result that the actual resource allocation is influenced by school sizes. The highest total unit costs 2009 received schools in size class 2 (81 to 180 learners; 2.198 €), followed by class 3 (181 to 360 learners; 2.189 €) and class 4 / 1 (361 to 540 learners; 2.101 € / under 81 learners; 2.066 €). The lowest average total unit costs was in the large schools in class 5 (over 540 learners) with only 1.930 € per learner. Related to the school size class 5 with the lowest unit cost values, the school size class 2 received about 168 € in 2008 / 268 € in 2009 more average total unit costs for general teaching.

Regarding the analysis of average total unit costs for general teaching by district and district size classes the findings are significant: The resource allocation is influenced by "urbanisation" (district population size and density).

The analysis of the variations between the districts on basis of the weighted average total unit costs for general teaching shows a wide range. It started in 2008 with 1.779 € in district Offenbach and ended with 2.443 € in Lahn-Dill district, also a variation of 664 € or 37,3%. In 2009 the spread led from 1.828 € in Rheingau-Taunus district to 2.546 € also in Lahn-Dill district (difference 718 € / 39,3%).

The analysis of the simple average total unit costs for general teaching is dependent on district size classes and shows that in tendency the districts with the higher population values have lower per

learner unit costs (2008: lowest population class 1 = 2.323 €, highest class 5 = 1.939 €; 2009: class 1 = 2.472 €, class 5 = 2.035 €).

The correlations between weighted average total unit costs for general teaching and the district population density (correlation coefficients -0,227 in 2008 and -0,202 in 2009) are also significant and confirm the unit cost results from above.

There is also a significant positive correlation between the district population and the average class size (correlation coefficient 0,380 in 2008, 0,337 in 2009) as well as between class size and district population density (correlation coefficient 0,641 in 2008, 0,673 in 2009). This means that the more people are in a district / the higher the population density, the higher the average class size is.

The district population density and the proportion of learners with migration backgrounds are high correlated (correlation coefficient 0,926 in 2008, 0,930 in 2009). The finding is that schools in urban areas have a higher proportion of migrant learners.

In Hesse schools get additional resources for the inclusive teaching of handicapped learners. In regard to the equity standards of Fiske & Ladd (2004; see chapter 2) this is an attempt to achieve "Equal Educational Opportunity", so to reach a higher level of equity. The average total unit costs for additional support for handicapped learners are very uneven. Expenditure was 37.862 € in 2008 and 34.291 € in 2009 per handicapped learner. This equated a decrease of about 9,4%. The schools in the 10th percentiles received only an average of 8.039 € (2008) / 7.780 € (2009) per learner whereas the schools in the 90th perecentile got 83.663 € (2008) / 70.190 € (2009). The Standard deviation was 39.881 € (2008) / 39.138 € (2009) and shows the broad variability of the distribution. This could be caused by an assignment problem with the new accounting system because the database of the years 2008 and 2009 were the first attempts of book keeping in product structures. Meetings with experts of the MoE Hesse confirm this assumption. The database for the cost accounting regarding the support for handicapped learners given by the yearly IT-based school survey is mostly not properly filled in. Irrespective of the fact that there were really handicapped learners these costs were distributed with the same amount to all schools with a cost object for support to handicapped learners as a simplification (if real school level data is missing). This problem only affects the additional resources for the support to handi-

capped learners and learners with migration backgrounds. The general teaching funds are not affected by this. The correlation between the special needs status (no. of handicapped learners) as well as the proportion of handicapped learners (%Handicapped) and the average total unit costs for additional support of handicapped learners are significant (-0,418 (2008) / -0,381 (2009) for no. of learners; -0,479 (2008) / -0,436 (2009) for %Handicapped). The analysis shows that a larger number of handicapped learners leads to a lower average of total unit costs for additional support of handicapped learners.

Schools in Hesse also get additional resources for the teaching of migrant learners to enable them to reach the same school graduations as their German schoolmates. This is also an effort to achieve the equity standard of "Equal Educational Opportunity" stated by Fiske & Ladd (2004; see chapter 2). The average total unit costs for learners with migration backgrounds were 8.102 € (2008) / 9.428 € (2009). Also here the distribution was uneven. The schools in the 10th percentiles received only 912 € (2008) / 871 € (2009) per learner on average whereas the schools in the 90th perecentile got 20.449 € (2008) / 22.903 € (2009). The Standard deviation was 12.625 € (2008) / 14.434 € (2009). The correlation analysis shows apparent disadvantages for larger schools with more learners (correlation coefficients between average total unit costs for learners with migration backgrounds and school size -0,433 in 2008 / -0,450 in 2009) as well as schools with a higher proportion of migrant learners (correlation coefficients -0,411 in 2008 / -0,423 in 2009). Significant positive correlations exist between the average total unit costs for learners with migration backgrounds and social status (correlation coefficients 0,363 in 2008 / 0,354 in 2009) as well as learner achievement (correlation coefficients 0,268 in 2008 / 0,296 in 2009). This finding is noteworthy because the higher the social status or the test scores are, the higher the total unit costs are. This implies funding advantages for schools with a higher social status.

But despite the accounting problems the actual additional resource allocation for handicapped and migrant learners is nevertheless not equitable on basis of per learner unit costs.

Although the analysis of correlations between school variables is not the core of the study, this last research step rounds off the view of the Hessian school system. There is a negative correlation be-

tween social status and average class size (-0,213) as well as school size (-0,372). The proportion of learners with migration backgrounds have a negative correlation with the learner achievement (-0,544 / -0,580) and the social status (-0,701 / -0,761). Further the social status and learner achievement are positively correlated (0,505), also average class size with school size and percentage of migrant learners (correlation coefficients 0,655, 0,253) are.

All results of the study show that the actual resource allocation to pure public primary schools in Hesse is not equal on the basis of per learner unit costs. This is influenced by urbanisation, school size and social status.

A solution could be to shift from a resource distribution based on reference classes to a dissemination by per learner unit costs with the consideration of the social status of a school. Also developments in the school structure (e.g. merge small schools in rural areas) in cooperation with the districts are reasonable especially due to the upcoming demographic changes. Further research regarding other school types is necessary because this study only focuses on pure primary schools. Also an advanced inquiry regarding the correlations between funds for learners with migration backgrounds and their school achievement / output could help to understand the impact and to enhance the aid for migrant learners. The cost assignment of the accounting system should be improved to get a better data quality for further cost analyses.

References:

Berne, Robert & Stiefel, Leanna (1994) *Measuring Equity at the School Level: The Finance Perspective.* Educational Evaluation and Policy Analysis, Winter 1994, Vol. 16, No. 4, pp. 405-421

Berne, Robert & Stiefel, Leanna (1999) *Concepts of School Finance Equity: 1970 to the Present. in Equity and adequacy in education finance: issues and perspectives* (Helen F. Ladd et al. eds., 1999). IV. National Research Council (U.S.). National Academy Press. Washington DC

Bray, Mark (1988) *School Size and Unit Costs: International Evidence and its Usefulness.* Research in Rural Education, Volume 5, Number 1. Pennsylvania State University, College of Education

Cavicchioni, V. & Motivans, A. (2001). *Monitoring educational disparities in less developed countries.* In: W. Hutmatcher, D. Cochrane, N. Bottani. (Eds.), In pursuit of equity in education: Using international indicators to compare equity policies (pp. 217-240). Kluwer Academic Publishers. Dordrecht

Colclough, Christopher & Al-Samarrai, Samer (2000) *Achieving Schooling for All: Budgetary Expenditures on Education in Sub-Saharan Africa and South Asia.* World Development Vol. 28, No. 11, pp. 1927-1944. Elsevier Science Ltd. London

Fiske, Edward B. & Ladd, Helen F. (2004) *Elusive Equity: Education Reform in Post-Apartheid South Africa.* Brookings Institution Press. Washington DC

German Bundestag (2009) *Basic Law for the Federal Republic of Germany*. (http://www. bundestag.de/dokumente/rechtsgrundlagen/grundgesetz/gg.html; last viewed 02.06.2010). Berlin

Hanushek, Eric A. & Luque, Javier A. (2001) Efficiency and Equity in Schools around the World. Stanford University, National Bureau of Economic Research,University of Texas at Dallas and University of Rochester

Hanushek, Eric A. & Woessmann, Ludger (2007) *The Role of School Improvement in Economic Development.* Working Paper 12832. National Bureau of Economic Research. Cambridge

Hunter, Molly A. (1999) *All Eyes Forward: Public Engagement and Educational Reform in Kentucky.* Journal of Law & Education, Volume 28, Number 4; October 1999, pp.485-516

Jacob, W. James, Holsinger, Donald B. & Mugimu, Christopher B. (2008) *Private Secondary Education in Uganda: Implications for Planning.* Teachers College Record, Volume 110, Number 4, 2008, pp. 867-893

Jarousse, J.P., Mingat, A. Tamayo S. & Tan, J.P. (1996) *Cost Analysis in Education, A Three-Part, Hands-on Training Module.* World Bank. Washington DC

Klein, Helmut E. & Plünnecke, Axel. (2010) *Bildung in Zeiten knpper Kassen: Pro-Kopf-Finanzierung statt Institutionenförderung.* Cologne Institut for Economic Research. Cologne. http://www.iwkoeln.de

McMillan, J. H. & Schumacher, S. (2006) *Research in Education: Evidence-Based Inquiry.* 6th ed., Pearson Education Inc. Boston

Mingat, A. & Tan, J.-P. (2003) *Research Tools for Education Policy Analysis*. World Bank. Washington DC

Motala, Shireen (2006) *Education Transformation in South Africa: The Impact of Finance Equity Reforms in Public Schooling after 1998.* Unpublished thesis. University of the Witwatersrand. Johannesburg

Murray, Sheila E., Evans, William N. & Schwab, Robert M. (1998) *Education-Finance Reform and the Distribution of Education Resources.* The American Economic Review, Vol. 88, No. 4, September 1998, pp.789-812

Sherman, Joel D. & Poirier, Jeffrey M. (2007) *Educational Equity and Public Policy: Comparing Results from 16 Countries.* UIS Working Paper No. 6. UNESCO Institut for Statistics. Montreal

Statistical Office Hesse (2009) *Data about the district areas and populations*. (http://www.statistik-hessen.de/themenauswahl/bevoelkerung-gebiet/regionaldaten/gebiet-bevoelkerungsstand-und-vorgaenge/index.html; last viewed 02.06.2010). Wiesbaden

Woessmann, Ludger (2007) *Fundamental Determinants of School Efficiency and Equity: German States as a Microcosm for OECD Countries.* University of Munich, Ifo Institute, CESifo and IZA, PEPG/07-02

Appendices

Appendix 1: District informations

District abbr.	District name	District population	Square kilometres per district	District population density
BS	Bergstraße	262.796	719,5	365,2
DA	Darmstadt City	143.332	122,1	1.174,0
DADI	Darmstadt-Dieburg	288.918	658,7	438,7
F	Frankfurt am Main City	671.927	248,3	2.706,0
FD	Fulda	217.759	1.380,4	157,8
GG	Groß-Gerau	253.599	453,1	559,8
GI	Gießen	255.765	854,6	299,3
HR	Hersfeld-Rotenburg	122.812	1.097,1	111,9
HTK	Hochtaunus	226.290	482,0	469,5
KSL	Kassel	237.973	1.292,8	184,1
KSS	Kassel City	194.774	106,8	1.824,1
LDK	Lahn-Dill	254.878	1.066,5	239,0
LM	Limburg-Weilburg	171.487	738,5	232,2
MKK	Main-Kinzig	407.022	1.397,6	291,2
MR	Marburg-Biedenkopf	251.150	1.262,6	198,9
MTK	Main-Taunus	226.647	222,4	1.019,1
OFL	Offenbach	337.163	356,3	946,3
OFS	Offenbach am Main City	118.770	44,9	2.645,8
OWK	Odenwald	97.502	624,0	156,3
RTK	Rheingau-Taunus	183.303	811,5	225,9
SEK	Schwalm-Eder	183.714	1.538,5	119,4
VB	Vogelsberg	110.989	1.459,0	76,1
WF	Waldeck-Frankenberg	163.129	1.848,6	88,2
WI	Wiesbaden City	277.493	203,9	1.360,9
WK	Wetterau	298.179	1.100,7	270,9
WM	Werra-Meißner	104.580	1.024,7	102,1

Appendix 2: Letter of Permission MoE Hesse

Hessisches Kultusministerium

HESSEN

Hessisches Kultusministerium · Postfach 3160 · 65021 Wiesbaden
University of the Witwatersrand
Prof. Brahm Fleisch
27 St Andrews Road
Parktown 2193
Johannesburg
South Africa

Geschäftszeichen
Bearbeiter: Herr Wolfgang Heimer
Durchwahl: 2618

Ihr Zeichen
Ihre Nachricht

Datum: 01.09.2010

Letter of Permission

Dear Prof. Fleisch,

please note that Mr. Udo Giegerich (MEd Student # 375156 at Wits University) has the permission of the Hessian Ministry of Education to conduct research and use our data for his study

„Equality in the Public Hessian School System: A Quantitative Analysis of the State Resource Allocation to Primary Schools Based on Per Learner Unit Costs".

The aim of the study is to assess the equality of the state resource allocation to pure primary public schools in the German state of Hesse on the basis of per learner unit costs and evaluate cost variations as well as correlations with key education indicators (school size, social status, learner achievement, class size, gender, urbanisation, immigration, special needs).

All used data is anonymous because it is aggregated to school level and not personal.

Mr. Giegerich has agreed to provide my office a copy of the approved study at the end of the research process.

Kind regards

On behalf of the Ministry of Education Hesse

Wolfgang Heimer
Deputy Director General

Luisenplatz 10 · 65185 Wiesbaden
Telefax (0611)368-2809
E-Mail: poststelle@hkm.hessen.de
Internet: www.kultusministerium.hessen.de

Appendix 3: Declaration

I, Udo Giegerich, do declare that this dissertation is my own unaided work. It is being submitted for the degree of a Master of Education (Policy, Planning and Management) at the University of the Witwatersrand, Johannesburg. It has not been submitted for any degree or examination at any other university.



_____ _____

Date Udo Giegerich