



TEACHER
MANAGEMENT AND
DEVELOPMENT



TEACHER DEMAND AND SUPPLY IN SECONDARY SCHOOLS

KARNATAKA AND MADHYA PRADESH



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TEACHER DEMAND & SUPPLY IN SECONDARY SCHOOLS

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List of Acronyms

B.Ed.	Bachelor in Education
B.Sc.Ed	Bachelor in Science and Education
CABE	Central Advisory Board of Education
CAC	Central Admission Cell
CBSE	Central Board of Secondary Education
CBZ	Chemistry, Biology and Zoology
CET	Common Entrance Test
CCE	Combined Competitive Examination
CPD	Continuing Professional Development
CTE	College of Teacher Education
CTET	Central Teacher Eligibility Test
DIET	District Institute of Education and Training
DEO	District Education Officer
DOE	Department of Education
EBB	Educationally Backward Blocks
F-KARE	Forum of Karnataka Retired Education Officers
GER	Gross Enrolment Ratio
GOI	Government of India
GOMP	Government of Madhya Pradesh
GMR	Global Monitoring Report
IASE	Institute of Advanced Studies in Education
IGNOU	Indira Gandhi National Open University
ITT	Initial Teacher Training
JRM	Joint Review Mission
MDG	Millennium Development Goals
M.Ed.	Master's in Education
MIS	Management Information Systems
MHRD	Ministry of Human Resource Development
MP	Madhya Pradesh
NCTE	National Council for Teacher Education
NCTL	National College of Teaching and Leadership
NER	Net Enrolment Ratio
NKC	National Knowledge Commission
NUEPA	National University of Educational Planning and Administration
OBC	Other Backward Classes
PGT	Post Graduate Teacher
PTR	Pupil Teacher Ratio
PCM	Physics/Chemistry/ Mathematics
RMSA	Rashtriya Madhyamik Shiksha Abhiyan
RMSA-TCA	Rashtriya Madhyamik Shiksha Abhiyan-Technical Cooperation Agency
SC	Scheduled Caste

SCERT	State Council of Education, Research and Training
SEMIS	Secondary Education Management Information System
SFD	Special Focus Districts
SMDC	School Management Development Committee
SPD	State Project Director
ST	Scheduled Tribe
TDS	Teacher Demand and Supply
TET	Teacher Eligibility Test
TGT	Trainee Graduate Teacher
TMD	Teacher Management & Development
UDISE	Unified District Information System for Education
UDT	Upper Division Teacher
UNESCO	United Nations Educational, Scientific and Cultural Organization
VYAPAM	Vyavsayik Pariksha Mandal

Executive Summary

Availability of required number of teachers is a key to ensure children's learning. Given the RMSA guidelines of ensuring availability of five subject specific teachers plus one head teacher and its criticality of specialist subject teacher availability, this study highlights issues and challenges impacting both demand and supply of subject specific teachers for secondary schools in Karnataka and Madhya Pradesh. In light of changing demographics in secondary school population it makes projections of teacher supply and demand in each state in the coming years. This report, based on mixed methods research, employs both primary research and secondary reviews, data and documentary analysis. It was undertaken as part of the technical support provided by the Technical Cooperation Agency-Rashtriya Madhyamik Shiksha Abhiyan (TCA-RMSA).

In-depth information about teacher supply and demand can guide better coordination between the number and kind of subject teacher trainees and demand of teachers by identifying either shortage or oversupply in terms of subject and geographical areas. In-depth analysis of teacher supply and demand in a state also can inform a range of related policies that affect the teaching profession, including standards of teacher preparation, certification requirements, in state and out of state recruitment practices, tenure, compensation systems etc.

Assessing the demand of secondary teachers is no simple task and is much more complicated than analysing supply and demand of teachers at elementary level, which can be calculated based on Pupil Teacher Ratio (PTR). Given that education is a concurrent subject and norms of subject teacher requirement at secondary level may differ for each state (e.g. language teachers needed), demand of teachers can also be different. Demographic changes and transition rates from elementary to secondary level, repetition rates at secondary level as well as shifts between government and private schools, and school populations and number of sections in secondary classes all influence demand. Demand of teachers is further influenced by the number of teachers retiring every year as well as transfers and deployment and can be of two types-growth demand and replacement demand.

Supply is calculated on the basis of availability of subject teachers for secondary classes at any given time, to fill in the current and future gaps in schools. This requires scrutiny of trends related to subject specialisation and number of students being trained as secondary school teachers. The implication therefore from the framework of teachers' supply and demand at secondary level is that any imbalance between demand and supply can technically be referred to as a shortage or oversupply of specific subject teachers.

Karnataka, a state located in southern India, targets universal secondary education, covering Classes VIII to X, by 2017, with 81.8 percent Gross Enrolment Ratio and 59.2 percent Net Enrolment Rate at secondary level in 2014-15. While the transition rate from elementary to secondary education was a high 94.2 percent in 2013-14, the transition from secondary to senior secondary level was a low 45.7. Government and aided¹ secondary schools (63 percent schools with 73 percent students enrolled) make up the largest group of secondary schools in Karnataka. It is important to note that most schools have one section each of Grades VIII-X and the majority of schools have less than 160 students enrolled and smaller schools have less subject teachers.

¹ The state government pays for teachers in private aided schools, though they are privately managed.

Demand for Secondary Teachers in Karnataka

Out of 106229 secondary teachers in the state 41 percent teachers are teaching in government schools, 27.5 percent in aided schools and 31 percent in private unaided schools. About 60 per cent teachers belong to the rural areas. Only 5.3 percent of all schools and 7.2 percent of government schools have five core subject teachers. More than 70 percent of the schools have at least two language teachers, at least one maths teacher and/or at least one science teacher. However, less than half of the schools have at least one social studies teacher. Lack of teacher deployment and small school size are the main factors that affect teacher distribution across schools.

Data on teachers teaching secondary classes reveals that 16.2 percent of teachers are teaching 'all subjects' as their main subject, while 65.6 percent were appointed for teaching 'all subjects'. This is extremely difficult to explain, since secondary school teachers are supposed to be B.Ed. teachers who can at best take up two methods papers in their teacher training course. Therefore they could potentially be teaching only their specialisation subjects and cannot be classified as 'all subject' teachers. Further analysis reveals that 32 percent of teachers do not have the required B.Ed. qualifications.

More than a quarter of secondary teachers are in the age group of 50 plus and would retire over the next decade and 59 percent of these teachers are teaching in rural schools, with close to 30 percent being language teachers. This is the basis of replacement demand in Karnataka.

Supply of Secondary Teachers in Karnataka: Karnataka has a total of 328 teacher training colleges affiliated to eleven universities located in 11 districts of the state (2014-15) and pass percentage was 95 percent. Close to 25,000 teachers are trained in Karnataka annually. A majority of students have taken up Arts subjects and are women belonging to minority communities. The combination of language with social science was the most popular subject specialisation of teacher trainees, followed by science with maths, science, language with maths and language with science.

Secondary Teacher Projections in Karnataka

Subject teacher demand in 2014-15 taking into account school populations and sections as well as replacement demand due to retirement was 32,228 teachers across all school managements in 2015. Government and aided schools required a total of 16,039 teachers, while private unaided schools had a shortfall of 14,944 teachers. Projections based on 2015 subject teacher shortage, changes in student enrolment based on population projections and GER of 97 percent in 2024, finds that demand of teachers is likely to increase till 2018 and then decline. Given that Karnataka has a total of 328 teacher training colleges with a capacity of producing 25,000 B.Ed. teachers annually, there does not seem to be a supply crunch of teachers.

Madhya Pradesh (MP), located in central India, aspires to meet the goal of universal secondary education with 80.2 percent Gross Enrolment Ratio and 42.9 percent Net Enrolment Rate in 2014-15 at secondary level. While the transition rate from elementary to secondary education was 78.8 percent in 2013-14, the transition from secondary to senior secondary level was a low 56.6. **A little more than half of secondary schools in the state are government-run (52%) and aided (2%), accommodating two-thirds of students enrolled.** The majority (57 percent) of the schools have a student population of less than 160 students.

Demand for Secondary Teachers in MP: A total of 71601 secondary teachers is reported by the state to this study. Among them almost two thirds are in government schools, one third in private unaided schools and less than two percent in aided schools. It is disappointing to see less than two percent of the schools meet the RMSA norm of five subject specialist teachers. However, around 60 percent of the schools are equipped with at least one social studies teacher, at least one science teacher or at least one maths teacher. Language teachers are in most demand with 43 percent of schools having at least two language teachers and 23 percent having 3 language teachers. While the data acquired by the study does not specify different language subjects, it is likely that the state experiences shortage in English teachers based on the interviews of state and district officials. Further analysis reveals that smaller-sized schools have fewer teachers and rural schools have more subject teachers available than urban schools.

Data on secondary teachers reveal that only 8 percent of teachers are found to be appointed and teaching 'all subjects'. Of these teachers classified as teaching 'all subjects' a majority of them are employed by private unaided schools. In terms of professional qualification of teachers, around half of teachers have a B.Ed. or M.Ed. Thus a large number of teachers found teaching secondary classes did not have the requisite qualifications and most of these were found in private unaided schools.

Almost 20 percent teachers are in the age group of 50 and more and will retire over the next ten – thirteen years causing a large number of vacancies to occur in the next decade or so.

Supply of Secondary Teachers in MP

There are approximately 567 B.Ed. colleges in the state affiliated to ten Universities in 2015 offering about 47000 seats for B.Ed. annually. The analysis of the supply side data highlighted that close to three-quarters of the seats were filled by Arts students in 2011-12 and 2012-13 and a majority of the teacher trainees were women. In the two academic sessions candidates who took up languages and Social studies combination constituted 58 and 55.3 percent, followed by language and science combination (20.2 and 21.2 percent). The next highest category was of language and mathematics (11.9 and 14.5 percent), while pure Science combinations were the smallest (7.5 percent). A limitation of the quantitative data was that the specific language subject that teachers had chosen e.g. Hindi, Sanskrit or English was not captured. Qualitative interviews with principals of private and government colleges of education highlighted the shortage of student teachers taking up English, Mathematics and Science.

Teacher Projections

Subject teacher demand in 2014-15 taking into account school populations and sections as well as replacement demand due to retirement was 42,240 teachers across all school managements. Government schools require a total of 22,910 teachers while private unaided schools have a shortfall of 18,138 teachers. Language teachers are in greatest demand. The projected population of 14-15 year olds is expected to decline till 2024. Projections based on 2015 subject teacher shortages employ two models keeping in view projected GER of 88 and 96 percent in 2024 respectively. The analysis finds that the demand for subject teachers is likely to increase till 2024, despite demographic decline.

Given that MP produces more than 47000 teachers every year from 516 CTEs, there does not seem to be a supply crunch of teachers. Even if we extrapolate from the qualitative evidence that around 50 percent of new teachers will join the teaching profession, there is no doubt that the supply is much more than the demand.

Overall Recommendations

The analysis shows that there exists a severe shortage of subject teachers in Karnataka and Madhya Pradesh, only miniscule proportion of secondary schools having five subject specialist teachers available. This fact is often hidden behind the significant number of teachers teaching “all subjects” due to very small size of secondary schools. However, considering that the supply of teachers exceeds the demand for them, delay in recruitment and lack of policy for deployment and transfer are more of concern than the shortage itself. The study has clearly identified certain areas that need policy attention in order to ensure that there is an equitable distribution of subject teachers across all schools:

1. **Better Teacher Recruitment and Deployment Policies:** While the supply of teachers seems to be sufficient to meet the demand of subject teachers in secondary schools in the states, that subject teacher vacancies in schools are mainly due to non-sanctioning of posts, lack of effective deployment and recruitment process delays and reservation policies such as roster system in tribal areas rather than shortage in teacher supply. Both states need to develop clear recruitment policies and implement them in regular cycles, and flexible deployment policies.
2. **Better Planning to Ensure Demand and Supply Synchronisation:** Streamlining demand and supply by long and short term planning will support the state/s to effectively manage its supply of subject teachers based on teacher demand and also assure newly trained teachers with job opportunities. This will require coordination between the Department of Higher education, NCTE and Department of Secondary Education in each state. This annual planning process should in turn lead to reliable information regarding demand of subject teachers by school management and location to be generated and lead to interventions that ensure the adequate number of teachers are trained in the subjects that are in short supply.
3. **Streamlining Recruitment:** Recruitment processes that are grossly delayed due to court orders and lead to sanctioned posts not being filled needs careful consideration. Alternatives to ensure that students are provided adequate subject specialists such as a pool of trained teachers who can be deputed as guest teachers needs to be planned.
4. **Clustering of Small Schools:** In light of the fact that Karnataka has 61 percent of schools and Madhya Pradesh has 57 percent with less than 160 students, it might be cost effective and efficient to merge small secondary schools in order to ensure that schools are provided adequate human resources. The policy option of clustering small schools or connecting small schools with a larger school with shared core subject specialist teachers could be explored. This way secondary schools will be able to get requisite number of teachers without undue wastage of human resources.
5. **Sanctioning of Posts:** Sanctioning of 5/6 subject teacher posts in each school is essential to ensure that all students are provided subject specialist teachers to provide them the content that they must learn as they prepare for their class X Board exams. If this is not done it will be most inefficient saving as investment in elementary education of thousands of students will be wasted as they cannot get school completion certificate that can only be given based on class X board examination results. There are no posts for teaching English in Karnataka, this will need to be addressed to meet RMSA goals of quality, equity and access. Merging small schools could be one

step to make schools more efficient by ensuring that all available teachers are placed in all the schools resulting in efficient utilisation of resources.

6. **Reservation of Seats in Colleges of Education Based on Subject Teacher Demand:** Given that more than 60 percent of teachers take up the Arts stream in both states, it is important to make a reservation or quota of seats in colleges by stream. This would aim towards encouraging students to take up subjects such as Science, English Language and Mathematics as well as certain languages, in which there is subject teacher shortage. It may be necessary for the states to pay special attention to subject teacher demand in rural and tribal areas by providing incentives not only to pursue B.Ed., but more importantly to encourage students to take up maths, science and English at higher secondary and under-graduate level.
7. **Strategic planning for meeting demand of teachers in tribal areas:** Given the workforce issues related to roster system prevalent in states such as Madhya Pradesh, a long term strategy to enable students from reserved categories to specialize in critical core subjects at the high school and tertiary levels is required. Short-term strategies include the provision of incentives for teachers from general pool to move to tribal areas for short tenures.
8. **Data Base of Teacher with Subject Specialisation:** In order to inform policy planning, information on subject specialisation of teacher trainees needs to be collected annually by higher education department/s and NCTE and quota for science and arts subjects should be prescribed by the state to meet the demand. UDISE data also needs strengthening and collection of desegregated data on specific subject teachers must be initiated, instead of combining them into categories of 'language teachers' or 'teaching all subjects'. Only then will the various data sources be able to provide data that will support analyses of flows into, out of, and within the teacher workforce.
9. **Data Base of Supply Pool:** The supply pool must also take into consideration teachers who are unemployed and would be interested in joining the teaching profession. This data base could be maintained by the regional committees of the NCTE.
10. **Professional Qualifications:** Unqualified secondary teachers need to be provided adequate training opportunities to ensure that there is no discrepancy between appointment of teachers and subjects taught in secondary schools. The state HRMIS could provide such data.
11. **Subject Specialisation:** Given that a large number of teachers may be teaching subjects that they are not qualified to teach, desegregated data at block and district level needs to capture this information, so that unqualified teachers can be added to the teacher shortage data.
12. **Monitor Private Unaided Schools:** Adequate monitoring of private unaided schools needs to be undertaken by states, since they seem to have a larger shortage of subject teachers.
13. **No expansion of Colleges of Teacher Education:** In light of the fact that both states have sufficient number of teacher colleges, there is no need to expand the number of teacher training institutions in the states to meet the secondary teacher demand till 2024
14. **Review of Two-Year B.Ed.:** Given that a large number of seats in the two year B.Ed. introduced in 2015-16 have not been filled, it will be important to review the situation in the coming years in order to take stock of the supply of subject teachers and make projections.

1. Introduction

Availability of required number of teachers is a primary factor for ensuring children's learning and it is vital that educational planning undertakes an analysis of teacher demand and supply, at appropriate points in time in order to ensure that students are provided with appropriately qualified teachers to enhance learning. The EFA Global Monitoring Reports (UNESCO 2010, UNESCO 2011) highlight that teacher shortages remain a serious concern. Though the focus of teacher availability has largely been on primary education, lately attention has moved to secondary education as well (Bird, Moon & Storey, 2013).

1.1 The Indian Context

India has an educational structure that consists of eight years of elementary education (I-VIII), followed by secondary education (IX-X) and higher secondary (XI-XII). Acknowledging that secondary education is a key link between education and economic development in order to prepare young adolescents to learn the life skills and participate in the growth process, policy makers have in recent years turned their attention towards universalising secondary education. The Central Advisory Board of Education (CABE) Committee Report (2005) highlighted that '*universal secondary education is a pre-condition for equitable social development, widening participation in India's democratic functioning, building up of an enlightened secular republic, and be globally competitive*' (p.14).

To meet the challenge of dramatically improving access, equity and quality of secondary education simultaneously, the government launched a centrally sponsored scheme for secondary education, Rashtriya Madhyamik Shiksha Abhiyan (RMSA) (MHRD, 2009). From a historical perspective, the significance of RMSA lies in the fact that for the first time ever, the Central Government began to support the States in expansion of access as well as improvement of the quality of secondary education, thereby bestowing on secondary education the attention it deserves (RMSA 3rd Joint Review Mission, 2014). The scheme seeks to enhance enrolment in Classes IX and X by providing a secondary school within a reasonable distance of every habitation, to improve quality of education imparted at secondary level by ensuring all secondary schools conform to prescribed/ standard norms, to remove gender, socio-economic and disability barriers and to achieve near universal enrolment in secondary level education with the Gross Enrolment Ratio (GER) exceeding 90 percent by 2017, i.e. by the end of the 12th Five Year Plan. Above all, it aims to dramatically improve learning outcomes so that young people leaving school can play their part in the development of the country.

In the last few years, the expansion of secondary/senior secondary schools in India has resulted in a considerable increase in enrolment at secondary level. While the number of schools increased by 118,606 from 2001 to 2015 (from 126,047 to 244,653), enrolment in secondary and higher secondary education increased by 34.2 million (from 27.6 million in 2001 to 61.8 million in 2015). The enrolment of boys increased by 15.6 million (from 16.9 million to 32.5 million) while the enrolment of girls increased by 18.5 million (from 10.7 million to 29.2 million) during the same period. The percent increase in enrolment has been much higher for girls (162.6 percent) than for boys (86.4 percent) during this period.

Table 1: Number of Secondary Schools and Enrolment in India by Gender 2000/01-2014/15

Year	Number of secondary/higher secondary schools	Enrolment in Secondary/Senior secondary education(in Millions)		
		Boys	Girls	Total
2000-01	1,26,047	16.9	10.7	27.6
2001-02	1,33,492	18.4	12.1	30.5
2002-03	1,37,207	19.5	13.7	33.2
2003-04	1,45,962	20.6	14.4	35
2004-05	1,52,049	21.7	15.4	37.1
2005-06	1,59,667	22.3	16.1	38.4
2006-07	1,69,568	23	16.9	39.9
2007-08	1,72,990	25.2	19.3	44.5
2008-09	1,93,200	25.6	19.9	45.5
2009-10	1,90,643	26.7	21.5	48.2
2010-11	2,00,184	28.3	22.9	51.2
2012-13	2,28,914	29	25.6	54.6
2013-14	2,37,111	31.5	28.1	59.6
2014-15	2,44,653	32.5	29.2	61.8

Source: UDISE

While the GER for Grades 9 and 10 in 2014/15 had increased to 78.5 from 76.6 in 2013-14 (NUEPA 2015), and the ratio of girls to boys enrolment at the national level remained constant at 0.9 (Grades 9–10). However, the Net Enrolment Ratio (NER) in 2014/15 at secondary level was still a low 48.5, an improvement from 45.6 in 2013-14. The average promotion rate in 2013/14 from Grade 9 to 10 was 82, while the transition rate from Grade 10 to Grade 11 remained a low 68.9 in 2013/14 with annual drop-out rates of 17.9 at national level (NUEPA 2014a). It is important to note that rural drop-out rate was much higher at 22.3 in 2013-14 as compared to urban drop-out 8.2 (NUEPA, 2014).

While efforts are ongoing to improve access to secondary education by RMSA, to attain higher retention and transition rates to higher secondary education, it is becoming increasingly clear that teacher preparation and workforce management is key to quality reform. A teacher and his or her role as instructor/facilitator is key to improving student learning, which in turn is dependent on a well-managed teacher workforce. Unfortunately, there is uneven distribution of teachers and extensive research suggests that children in high-poverty schools are much more likely to be assigned teachers with lower academic qualifications (Peske and Haycock, 2006; Clotfelter et al., 2007).

Given the importance of teacher management and development for the secondary level, RMSA-TCA carried out a review of Teacher Management & Development (TMD) in 2014 in the states of Madhya Pradesh, Assam and Karnataka in order to get an understanding of three key areas related to secondary level teacher cadre management; (1) *Teacher supply and recruitment*, (2) *Teacher deployment and redeployment* and (3) *Teacher Service conditions and continuous professional development*.

The TMD review drew attention to intra-state disparities related to subject teacher vacancies at secondary level, particularly in rural areas and special focus districts. However, the TMD review highlighted the need to undertake a comprehensive study related to teacher supply and demand,

since the secondary data analysis from the Unified District Information System for Education (UDISE) did not provide sufficient information on shortage or over supply of teachers in specific subjects.

1.1.1 Teacher Preparation

For pre service training, the National Council of Teacher Education (NCTE), a statutory body of the central government, is responsible for planned and coordinated development of teacher education in the country. The NCTE lays down norms and standards for various teacher education courses, minimum qualifications for teacher educators, course content and duration and minimum qualification for entry of student teachers for various courses. It also grants recognition to institutions (government, government-aided and private) interested in undertaking such courses and has the mandate to regulate and monitor their standards and quality. To be able to comment on whether there is a shortage or over-supply of teachers in specific subjects, an analysis of subject teachers being prepared by teacher training institutions in each state becomes essential. Each state has its own academic and professional standards for teachers in government schools, although a university degree plus a Bachelor of Education (B. Ed) degree is the minimum requirement for secondary education. Most pre-service teacher education conducting B.Ed. courses are privately financed. Some programmes like the integrated 4-year Bachelors in Science and Education (B.Sc.Ed.), which combines a university degree with a secondary teacher qualification, are run only in a few government institutions like the Regional Institute of Education, Bhopal.

Under NCTE Regulations (2007), all institutions running B.Ed. colleges need to be affiliated to a University and have to get recognition from one of four NCTE Regional Committees. The NCTE rules highlight that establishment of teacher training institutions by the Government, private managements or any other agencies should largely be determined by assessed need for trained teachers. This need is supposed to take into consideration the supply of trained teachers from existing institutions, the requirement of such teachers in relation to enrolment projections at various stages, the attrition rates among trained teachers due to superannuation, change of occupation, death, etc. and the number of trained teachers on the live register of the employment exchanges seeking employment and the possibility of their deployment. The States having more than the required number of trained teachers are not encouraged to open new institutions for teacher education or to increase the intake.

NCTE developed the National Curriculum Framework for Teacher Education in 2009 and observed that 'one-year second Bachelor's degree (B.Ed.) model seemed to have outlived its relevance' (p.10, NCTE, 2009). As a result, from the academic session 2015-16, NCTE has introduced a two-year B.Ed. course. Furthermore, since 2012, Central Teacher Eligibility Test (CTET) are being conducted by the Central Board of Secondary Education (CBSE) and States to assess competence of teachers who have completed pre-service teacher training, before considering candidates eligible for government jobs.

1.2 Scope: Teacher Demand & Supply Study

Given that education is a concurrent subject and norms of subject teacher requirement at secondary level may differ for each state (e.g. language teachers needed), RMSA-TCA in collaboration with state governments decided to study the pattern of teacher supply and demand at secondary level in two of the states in which the TMD review had already been conducted- Karnataka and Madhya Pradesh. This study aimed to explore factors that influence supply and demand of secondary school teachers and shortages (if existing) in subject teachers in the two states, in light of changing demographics in secondary school population and make projections of teacher supply and demand in each state in the coming years.

More in-depth information about teacher supply and demand is important because it can guide better coordination between the number and type of subject teachers trained by teacher institutions and demand of teachers by identifying subject and geographical areas which lack requisite teachers. In-depth analysis of teacher supply and demand in a state also can inform a range of related policies that affect the teaching profession, including standards of teacher preparation, certification requirements, in state and out of state recruitment practices, tenure, compensation systems etc. Such an analysis can also reveal the severity of shortages and provide diagnostic information on which sources of teacher supply or governance related issues are contributing to the shortages.

Therefore, we hope that this study focussing in specific on secondary teacher supply and demand in Karnataka and Madhya Pradesh will support the state/s to evolve a framework for policy that creates a coherent infrastructure of teacher preparation, recruitment and support to meet current demands for secondary subject teachers based on their expansion plans and population projections in government and government-aided schools.

1.2.1 Demand

Assessing the demand of secondary teachers is no simple task and is much more complicated than analysing supply and demand of teachers at elementary level, which can be calculated based on Pupil Teacher Ratio (PTR). The demand of teachers at secondary level cannot be calculated using PTR, since there needs a minimum of five subject teachers for secondary classes. Demographic changes and transition rates from elementary to secondary level, repetition rates in Grade IX as well as shifts between government and private schools, and school populations and number of sections in secondary classes all influence the projection. Demand of teachers is further influenced by the number of teachers retiring every year as well as transfers and deployment. Changes in requirement if showing upward trends are generally referred to as 'growth demand'. Educators leaving the sector due to superannuation or other reasons are referred to as 'replacement demand'. Demand is therefore understood as growth demand plus replacement demand. Furthermore, there may be issues related to quality of teachers particularly if there exists a mismatch between subject specialization and level with teaching assignment that teachers have been accorded. Some of the teachers employed several years ago, may have subject specialisation but not have the requisite teacher professional qualifications, while others may not be employed to teach the subject they have specialised in. Demand for teachers varies from place to place and certain subject teachers may be in short supply, because graduates in those subjects do not opt to pursue teaching careers.

1.2.2 Supply:

Supply of teachers on the other hand refers to the number of eligible individuals available from all sources that are willing to supply their services under prevailing conditions (Lindsay, Wan & Gossin-Wilson, 2009). It is therefore the availability of subject teachers for secondary classes at any given time, to fill in the current and future gaps in schools. An inadequate supply of teachers in relation to demand inevitably results in a shortage (Boe, 2006:138). Thus teacher supply needs to be analysed from the perspective of gender, social and reserved categories and subject-specific gaps that might exist for secondary education.

The theory of supply and demand holds that where the quantity of teachers demanded is greater than the quantity of teachers supplied given the prevailing wages and conditions then, there is a shortage (Ingersoll and Perda, 2009:36). The implication therefore from the framework of teachers'

supply and demand at secondary level is that any imbalance between demand and supply can technically be referred to as a shortage or oversupply of specific subject teachers.

The Teacher Demand and Supply Study will evaluate the following research questions:

- (1) Whether demand and supply of teacher workforce at secondary stage are compatible in Karnataka and MP, by subject and location?
- (2) Factors that influence supply and demand of secondary school teachers and shortages (if existing) in subject teachers in the two states, in light of changing demographics and projections in secondary school population.
- (3) Impact of teacher shortage at secondary level and strategies selected schools employ for dealing with subject teacher demand or shortages

This report is organised in six chapters. While Chapter 1 provided an insight into the context, Chapter 2 focuses on a systematic literature review to inform the research and help define the components of teacher supply and demand. Chapter 3 deals with methodology and provides the analytical model around which the analysis of the study is framed. Chapter 4 pertains to analysis of demand and supply in the state of Karnataka, followed by Chapter 5 which analyses secondary teacher demand and supply in Madhya Pradesh. Chapter 6 provides a summary of the results and recommendations for streamlining teacher demand and supply at secondary level.

2. Review of Literature

In India, the importance of the teacher was recognised by the Kothari Commission as early as 1964-66 which recommended “securing a sufficient supply of high quality recruits to the teaching profession by increasing the status of teachers and providing them with the best possible professional preparation and satisfactory conditions of work” (GOI, 1966, Ch 3, Sec 3.01). This echoed the UNESCO 1966 *Recommendation Concerning the Status of Teachers* which stated that

‘In developing countries where supply considerations may necessitate short-term intensive emergency preparation programmes for teachers, a fully professional, extensive programme should be available in order to produce corps of professionally prepared teachers competent to guide and direct the educational enterprise’ (UNESCO, 1966: 39-40)

With Millennium Development Goals (MDGs) are coming to a close and nation states having signed the Sustainable Development Goals with universalisation of secondary education as one of its targets, there is once again increased interest in the availability of trained teachers to meet the new goals. For several decades, it has been argued in the literature that secondary education needs to be expanded both as a response to increased social demand and as a feeder cadre for higher education, giving little emphasis to its other important functions (Biswal, 2011). He highlighted that apart from the bottom-up pressure (i.e. arising from the growth of primary schooling) and the top-down pressure (as the source of potential intakes for higher education) for its expansion, there is a need to pay greater attention to secondary education as it caters to the needs of an important segment of the population – adolescents and youth, the source of the future human and social capital of a nation (Biswal, 2011).

2.1 Building an Effective Teacher Workforce

In order to meet the goal of an effective teacher workforce, systemic reform requires the thoughtful orchestration of multiple processes working together in a human capital system. Myung et al. (2013) state that supply chain management applied to school systems focuses on a systems view of the supply of new teachers with an eye to ensuring the quality of their preparation by developing strong partnerships between supplier and recipient. Engle and Jacobs (2011) posit that the knowledge that teachers matter, has been accompanied by an increased interest in understanding teacher labour markets. Teacher preparation institutions should have the same aim of providing quality education as the district administration running schools, and both should collaborate toward building a stronger teacher workforce through a mutually beneficial partnership.

2.1.1 Limited Capacity of Teacher Preparation

Huge disparities exist with respect to teacher availability within and across countries and rural areas remain very badly affected by teacher shortage in developing countries. Moon (2013) reiterated that the institutions created in the twentieth century to train teachers will be insufficient to meet the needs of the present century. In country after country, the shortfall between capacity and need can be extreme. While the EFA Global Monitoring Report 2011 reported that an additional 1.9 million teachers would be required by 2015, Mulkeen et al. (2007) posit that a similar situation exists for secondary education, with particularly acute shortage of mathematics and science teachers. In many parts of Africa it is stated that the demand for secondary school teachers substantially exceeds the supply due to factors such as bottlenecks in teacher preparation system and perceived unattractive conditions of service (Mulkeen et al., 2007).

The National Knowledge Commission (NKC, 2007) had observed that teachers are the single most important element of the school system and the country was facing a severe shortage of qualified and motivated school teachers at different levels. In India one million extra teachers were needed for elementary education when Right to Education was passed, and huge disparities existed amongst and within states, with highest shortfall between training capacity and need existing in states such as Bihar and Orissa which also had the highest proportion of unqualified teachers. The Third RMSA Joint Review Mission (JRM) noted that there existed a nationwide shortage of science and mathematics teachers, which had far reaching implications in India. This included the present cohorts of students not being able to acquire the skills and competencies they need in these subjects, and also meant that these students were less likely to seek scientifically oriented degrees and employment, which in turn would further reduce the supply of such teachers (RMSA, 2014).

2.1.2 Location Disadvantage

In many countries there are staffing crises in disadvantaged areas, such as remote rural communities and inner cities (Gaynor, 1998). UNESCO GMR Report 2010, highlighted that women teachers in particular, do not accept jobs in rural schools due to harsh conditions including lack of transportation and health facilities. Engle and Jacob (2011) while analysing applicants to Chicago public schools found that geographic location of a school is an extremely strong predictor of applications even after controlling for a host of school and neighbourhood characteristics and this was reiterated by Kitchenham and Chasteauneuf (2010) in a study of Canadian schools. World Bank (2009) stated that the teacher vacancy problem is more marked in rural areas since rural schools in much of India have particular difficulty finding subject teachers in English, mathematics, and science because few qualified teachers wish to work there. Court cases against certain recruitment drives by government further delay recruitment for long periods.

2.1.3 Poor Teacher Management & Recruitment

According to a recent report commissioned by the global consultancy firm, *McKinsey and Company*, what separates the world's top-performing school systems from low-performing ones in the United States is USA's comparative inability to attract and retain highly effective teachers (Mourshed and Barber, 2007). The teacher hiring process has often been criticized as bureaucratic, cumbersome, inefficient, late, and rushed (DeArmond and Goldhaber 2005; Liu and Johnson 2006). District personnel systems can be poorly organized, inefficient, or dysfunctional. Hard-to-staff districts start the hiring process with a disadvantage (namely, that fewer candidates desire to work there), and these reasons for the late hiring of candidates exacerbate the issue. (Liu and Johnson, 2006). Shreshta (2008) stated that in Nepal, absence of required secondary teachers in required subjects was critical in operating schools efficiently. In his view, teacher management had been implemented very inefficiently and this had immense implication on the quality of education in schools.

Batra (2012) states that expansion in the number of teachers in India has been abysmally slow compared to the number of children enrolling for education and observed that teacher recruitment in most states remained frozen for many years. Myung et al. (2013) had set forth various reasons for recruitment failure at the district level. First, some districts have a difficult time predicting student enrolment, which in turn creates challenges in determining appropriate staffing levels. Second, collective bargaining agreements stipulate the completion of transfer process requests for tenured teachers before new teachers can be hired. Third, the date for notification of retirement is very late

in the calendar year, making it difficult for schools and districts to accurately forecast their personnel needs. Fourth, many districts are dependent on state and local budget decisions, which are often characterized by year-to-year budget uncertainties.

Eklavya (2015) noted that one round of recruitment of contract teachers based on Teacher Eligibility Test (TET) in Madhya Pradesh took almost 2 years and close to 24000 advertised posts were not filled due to (a) non availability of trained teachers in general and of that only a small proportion could clear the TET; and (b) SSS grade II were tested for subject knowledge and appropriate candidates were not available for English, Mathematics and Science. They reported that candidates for the specific subjects were in short supply even in the general category, besides SC/ST.

2.2 Models of Teacher Supply and Demand

Studying supply and demand of teachers at secondary level is not an easy task since it involves an analysis of complicated relationship between different variables to gain insight on the expected number of teachers employed throughout a period and the number of teachers required in the future (MCEETYA, 2003). Many studies have highlighted the difficulty in getting data from various sources involved in teacher supply and demand and Ballantyne et al. (2001) described lack of quality data that was accessible and credible to all parties in Australia.

2.2.1 Research on Demand

A demand projection is an estimate of the number of teachers that will be "required" in the future (e.g., to maintain some stipulated teacher-pupil ratio), but, according to the economic definition, it is an estimate of how many teachers school systems will seek to employ, contingent on certain projected values of an array of underlying determinants of demand (NRC, 1992:134).

Haggstom et al. (1988) stated that the demand for new teaching staff at the start of any hiring season depends on (1) enrolment growth, caused by changes in the size of the relevant student population and changes in the entrance or continuation rates of students; (2) changes in pupil/teacher ratios, caused by changes in staffing patterns, class sizes or teaching loads, and program offerings or course requirements affecting the relevant category of teachers; and (3) teacher turnover, the sum of losses resulting from retirements, death, disability, exits into nonteaching employment or homemaking, involuntary losses (firings or layoffs), and promotions.

As mentioned earlier demand can be two types-growth demand and replacement demand. Furthermore, in the Indian context the demand of teachers at secondary level cannot be calculated using PTR, since there is a minimum of six subject teachers for secondary classes and state recruitment policy determine how many sanctioned posts allocated for subjects based on school populations and state budgetary allocation. In Karnataka, only 15 teachers per block can opt to pursue higher education and the state due to a large number of existing vacancies has granted permission for the same only to those teachers who want to pursue higher degree in English, Mathematics and Science due to shortage in these subjects (CBPS-Karnataka, 2015). Demand for teachers in states such as Madhya Pradesh may be further complicated by reservations of certain social caste teachers in specific districts e.g. reservation for Scheduled Tribes (STs) within tribal dominated districts.

Examining the demand for subject teachers, the TMD Review (RMSA-TCA, 2015) found that a large number of secondary schools did not have the requisite subject teachers in both Karnataka and

Madhya Pradesh. Due to lack of data in relation to specific languages taught, the review analysed UDISE raw data 2013-14 provided by the states, to check availability of only five subject teachers across all schools- government , aided and unaided. The study found that approximately 11 percent of secondary schools had all four subject teachers in Karnataka while 58 percent of total schools in Madhya Pradesh had four subject teachers (RMSA-TCA, 2015).

It is important to note that calculating demand for teachers is a complex issue especially for composite schools where secondary teachers are shared between grades 6 to 10 or between grades 9 to 12 as the case may be. In addition the shortage of math and science teachers is a challenge for schools when they plan and deploy teachers. A single math, science or English teacher in a composite school may be required to teach the upper primary and secondary classes (JRM, 2014). Also if there are more than two sections per secondary grade, additional teachers will be required due to the extra teacher workload.

2.2.2 Research on Supply

Supply of teachers refers to the number of eligible individuals available from all sources that are willing to supply their services under prevailing conditions (Lindsay, Wan & Gossin-Wilson, 2009) and is more complex than calculating demand for teachers. Supply is calculated on the basis of availability of subject teachers for secondary classes at any given time, to fill in the current and future gaps of in schools. The supply includes qualified individuals who (a) seek to enter the profession by applying for open positions, and (b) would apply for positions if suitable openings existed (NRC, 1992:25). An inadequate supply of teachers in relation to demand inevitably results in a shortage (Boe, 2006) and assessments of supply must take into account the qualifications of current and potential teachers (Haggstrom et. al, 1988). This requires scrutiny of trends related to subject specialisation and number of students being trained as secondary school teachers . Besides new and continuing teachers supply needs to look into the reserve pool. The latter refers to the pool of individuals who are qualified to teach but who are not currently teaching, because they left teaching temporarily for personal reasons, pursue further education, entered other occupations, or are not hired by any school (Gilford and Tenebaum, 1990). Assessing the supply potential of the reserve pool depends on estimating how many of these individuals would consider re-entering teaching under various conditions, which is difficult to predict.

2.2.3 Teacher Training Institutes in India

Batra (2012) remarking on the poor institutional capacity for teacher training in India stated that there were a total of 7300 teacher training institutes approved by the NCTE in 2007 and of these, 51 percent were engaged with the training of secondary school teachers. The total seats offered for B.Ed. was 0.3 million seats and only 20 thousand of these seats approved by the NCTE were university-based. There has been a recognition of subject teacher paucity and it has been suggested that public funding should target training of teachers in subjects which require more training, e.g. mathematics, and/or to conform to reservations policies for hiring of SCs, STs, women, etc. as secondary level teachers (MHRD, 2009)

2.2.4 Issues related to Recruitment

State and district personnel policies regarding certification, compensation, recruitment, and deployment would definitely mediate between the demand for teachers and the supply of potential teachers to shape the teaching force at any given time. These policies, along with labour market

conditions and factors affecting the relative attractiveness of teaching would undoubtedly influence the supply pattern. In India, World Bank (2009) reported that fiscal constraints and litigation on teacher recruitment often delay the filling of vacancies – the former through hiring freezes or reductions of grants in-aid, and the latter through court injunctions against recruitment while litigation is in progress. Also teacher training institutions do not plan their student intake on the basis of demand forecasts, producing too many graduates in some subjects (such as humanities and social sciences) and too few graduates in others, notably mathematics, science, and English and in reserved categories. The recently introduced Teacher Eligibility Test (TET) which screens teachers before recruitment in government schools may be another strong factor that would influence supply of teachers in India and it is yet to be seen how the newly introduced two-year certification of B.Ed. in 2015-16, would impact people entering the teaching profession. In Karnataka TET is the eligibility test for primary teachers, whereas Competitive Central Examination (CCE) is held for secondary teachers.

2.3 Teacher Demand and Supply (TDS) Projection Models

The continuing concern of educational policy makers over the adequacy of the prospective supply of teachers in relation to demand has stimulated efforts over the years to produce data that could be used in projections of future supply-demand balance (Raphael, 2009). Many of these efforts have focused on producing data bases fundamental to teacher supply and demand analyses and some efforts have focused on developing the analytic tools required to use these data to provide information needed by policy makers and others. (NRC, 1992:43).

Characteristics of Projection Models

The types of information that can be generated with a supply-demand projection model depends on several model characteristics. One such characteristic is the extent of disaggregation of teachers by subject matter specialty and other variables. Some models deal only with teachers in the aggregate; others disaggregate in ways that make it possible to respond to detailed policy questions

Another key characteristic is whether a teacher supply-demand projection model is mechanical or behavioural. Mechanical models estimate only what will happen in the future if established trends continue. Behavioural models, in contrast, link demand and supply estimates to changes in pertinent conditions and policies. Only behavioural models can be used to address "what if" questions about the effects of hypothetical changes in circumstances on teacher supply and demand (NRC, 1992).

A third critical attribute of teacher supply-demand projection models is whether and how they deal with teacher quality. Unfortunately, nearly all projection models avoid the quality dimension and focus only on numbers of teachers. (NRC, 1992).

Not many behavioural demand models have been developed that will show how the pupil-teacher ratios will change with future changes in causal factors such as economic, demographic, or fiscal conditions. Such forecasts require assessments of broad demographic trends as well as subtle analyses of the factors motivating teachers, potential teachers, and students beyond compulsory attendance age cut-offs. Raphael, 2009 highlighted that forecasting the future contains both mechanical elements driven by forces determined outside of the education arena as well as behavioral analysis in assessing the responses of teachers and students to the parameters set by policy makers and educational administrators. For example, detailed analyses of the age distribution

of the current teacher workforce in conjunction with age-specific analysis of teacher attrition may reveal coming teacher shortages associated with a pending wave of retirements

2.3.1 Types of TDS Models

Barro (1992) states that a TDS *projection model* consists of a set of mathematical relationships that can be used to estimate future levels of teacher supply and demand. Ideally, these projections are linked to future economic and educational conditions and policies. When specified in detail, teacher demand can be compared with information about teacher supply to examine supply-demand relationships. Models for predictions of demand and supply consists of a set of mathematical relationships that can be used to estimate future levels of teacher's supply and demand. A complete model consists of three main components, or sub models, for projecting: (a) the demand for teachers, (b) the supply of teachers retained from year to year (or, equivalently, a model of teacher attrition), and (c) the supply of potential entrants into the active teaching force. The latter two components, taken together, constitute projections of total teacher supply, which (ideally) can be compared with projections of total demand.

In contrast with projection models, *system models* provide only a cross-sectional identification and organization of major variables involved in understanding teacher supply-demand: they do not involve other variables and equations needed to estimate future trends in supply and demand.

2.3.2 Projecting demand

The prevailing method for projecting demand is the mechanical method of multiplying projected student enrolments by current or extrapolated teacher-pupil ratios. The simple, standard demand model of this type can be expressed as follows: (Projected number of teachers demanded in year t) = (Projected student enrolment in year t) × (Projected teacher-pupil ratio in year t). This method yields no information on how the teacher-pupil ratios themselves, and hence the numbers of teachers demanded, can be expected to change in the future in response to changes in school policy, course enrolment patterns, and economic and demographic conditions. This does not mean that such projections are necessarily inaccurate, but it minimizes their utility in policy analysis.

2.3.3 Teacher Retention and Attrition Models

The primary source of supply of total teachers in any year is the active teaching force during the prior year. Typically, 92 to 96 percent of a state's teaching force continues from one year to the next. The remainder constitute annual attrition from the active teaching force. The simple, standard retention model can be expressed as follows: (Projected number of teachers retained from year t to year t + 1) = (Number of teachers employed in year t) × (Projected teacher retention percent for year t). The difference between total teacher demand and retained teachers represents the number of entering teachers that need to be hired to satisfy demand fully. Hence, it is very important to be able to estimate teacher retention (or attrition) accurately because even a small percent error in estimating teacher retention translates into a large percent error in estimating the number of entering teachers to be hired (NRC, 1992: 47).

At their best, state projection models in developed countries for teacher retention differentiate extensively among various categories of teachers. The more sophisticated retention models project numbers of continuing teachers by applying age-specific attrition rates to age distributions of teachers, differentiating also by level of education and subject specialty.

In short, retention/attrition projection models are the most advanced elements of teacher supply-demand models, and further progress using recent research findings can be expected, widening the sophistication gap between attrition models and those for other components (NRC, 1992: 48).

2.3.4 Entering Teachers

To satisfy teacher demand fully, entering teachers must be hired to augment the number of teachers retained from the prior year. The supply of potential entering teachers yields the number of entering teachers that are hired annually to augment the number of retained teachers. Estimates of future demand for entering teachers can be obtained by subtracting the projected number of retained teachers from the projected demand for teachers. Then comparisons between the projected numbers of entrants needed and the projected supply of entrants should lead to conclusions about the adequacy of supply and therefore the likelihood of future teacher shortages or surpluses. Although the number of teachers entering the profession annually can be measured and projected, the supply of potential entrants cannot be measured or projected, at the present time, for any of the sources of supply. Little credence should be given, therefore, to any projections of teacher shortage or surplus based on comparisons between projections of demand and purported projections of supply (NRC, 1992).

The main problem in modelling entering teacher supply is that the number of eligible individuals willing to supply their services as teachers at a given point in time under the conditions prevailing at that time is not known with respect to any of the sources of supply. While estimates can be made, for example, of the number of experienced (but inactive) teachers and the number of recently trained teachers, no data are available about the proportion of these groups that are available to enter the teaching profession.

The lack of adequate methods, or even a sound conceptual framework, for projecting the supply of potential entrants into teaching continues to prevent the development of complete supply-demand models that can be used to assess the supply-demand balance. Many current models offer no projections at all of the supply of potential entrants into teaching. Those do rely on one or the other of two unsatisfactory approaches. The first approach, equating the projected supply to the projected stock of persons certified to teach in a state, is clearly inadequate. Many certified persons are not in the supply (i.e., willing to teach under current conditions), and many persons in the supply may not (yet) be certified. The second approach, projecting supply by applying past entry rates to numbers of persons presumed to be in various supply pools, is invalid because past entry rates are more likely to have been determined by numbers of open teaching positions (demand) than by numbers available (supply). Most model developers have not yet come to grips with the fundamental problem that, if past hiring mainly reflects demand, then supply cannot be inferred from it. Consequently, data on employment and hiring cannot be used to measure current teacher supply nor to project future supply. Additional information is needed to estimate how many teachers would be available to take teaching jobs if hiring were not limited by demand.

2.3.5 Quality Variable

Undoubtedly, the quality variable within the supply model is critical, since the McKinsey report (Barber and Mourshed, 2007) that investigated the world's best school systems posited that the main driver in the variation of learning in school, is the quality of the teacher.

The report highlights three things that high-performing schools do:

1. They get the right people to become teachers
2. They develop these people into effective instructors.
3. They put in place systems and support to ensure that every child benefits from excellent instruction (Barber and Mourshed, 2007: 12–13):

The first two factors are directly related to supply and In order to introduce the feasibility of introducing a quality variable into the supply model, the principal available strategy for improving teacher quality is to use a higher quality standard in hiring entering teachers, thereby gradually altering the quality of the teaching force. In principle, prospective entrants could be classified by quality, and separate entry rates or propensities to apply for positions could be determined for persons in the different quality strata. Most supply and demand models given the constraint of data related to quality do not add quality dimension in the supply model.

2.4 Information Needed for TDS Projection models

In order to develop a comprehensive teacher supply and demand model, some of the critical information required relates to subject-specific course enrolment; unemployed pool of certified teachers; Teacher-Pupil Ratios; Teacher Migration; Supply-Demand Analysis of subject teachers especially Science and Math Teachers; Teacher Mobility; Teacher Retirement; Teacher Retention/Attrition Projections and Entering-Teacher Projections. There is no integrated and complete teacher data base or teacher management information system that captures the following dimensions:

- Numbers of teachers by level, sector, and field;
- Utilization (level and nature of teaching assignment, subjects taught, class sizes, other duties);
- Qualifications (teaching experience, certification status, fields qualified to teach) and Subject being taught;
- Teachers entering the field by subject specialisation
- Number of teachers passing teacher eligibility test by subject and
- Demographic and socio-economic characteristics of qualifying teachers

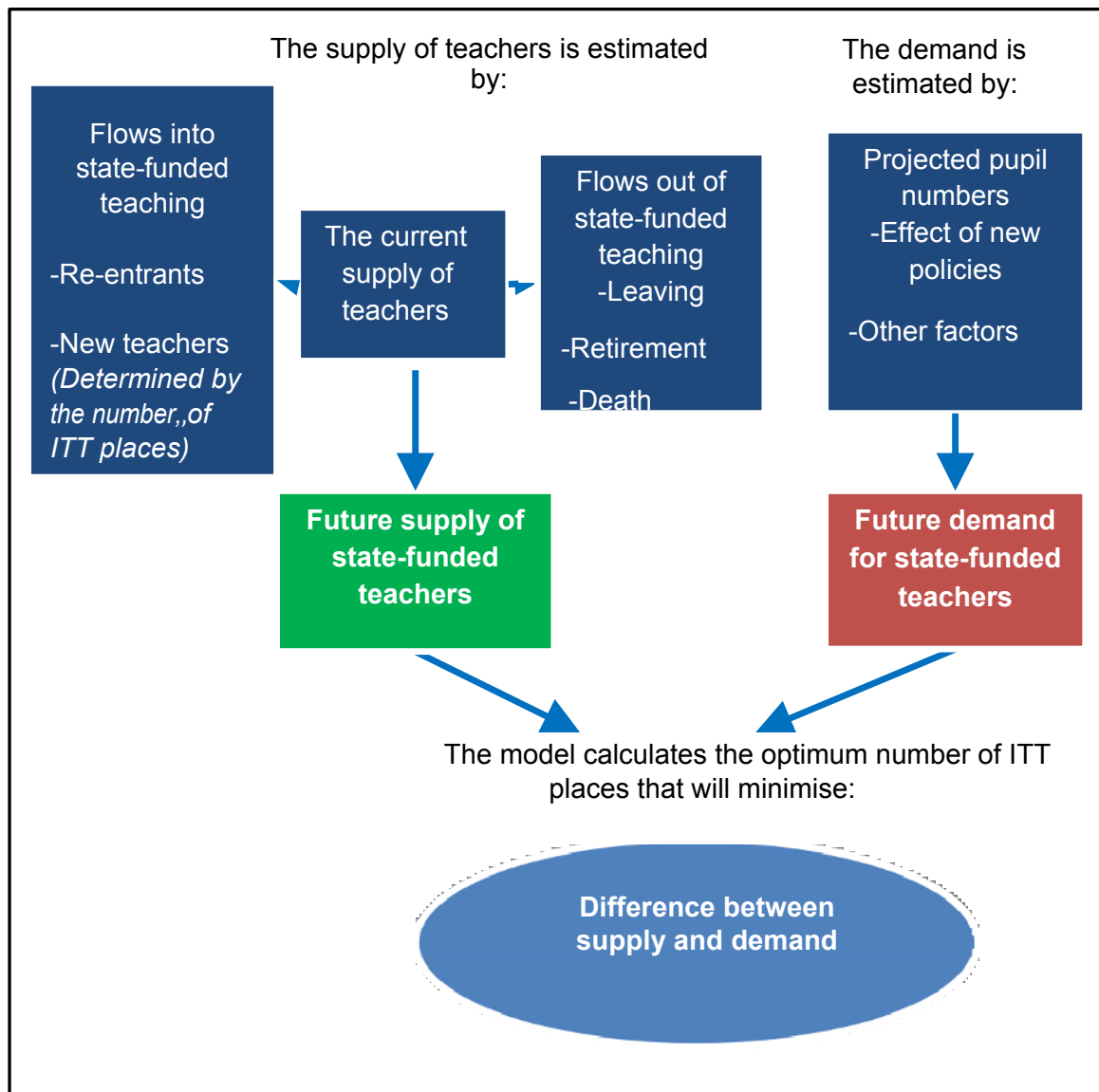
2.4.1 Teacher supply model UK

The Department for Education, UK uses the Teacher Supply Model to calculate the optimum number of Initial Teacher Training (ITT) places required to match the future supply of teachers to the estimated demand for qualified teachers within the state funded sector in England. This information is used by the National College of Teaching and Leadership (NCTL) when allocating ITT places to training providers (Department of Education (DOE), 2013)

The number of ITT places allocated nationally (represented in the model by x) feeds into the modelling of the future supply of teachers. The purpose of the model is to calculate the optimum value of ITT places, x , that minimises the difference between supply and demand and provides at least as many teachers as the state-funded sector will require (DOE, 2013).

The modelling in Figure 1 is performed for future years, with the closing supply of state-funded teachers from every year forming the opening supply of teachers for the next year. Estimates for the future are based closely on data from recent years, with some adjustments made for known policy changes in particular subjects (DOE, 2013).

Figure 1: A high-level view of the Teacher Supply Model



Model: RAND Corporation

In so far as national projections of teacher supply and demand are concerned, it is natural to focus attention on stocks of teachers, former teachers, and potential teachers, and to consider their transitions (or flows) across categories that correspond to sources of supply or demand. The stock of teachers, $T(t)$, at the beginning of school year t can be divided into four components of teacher supply: (1) new entrants into the system; (2) former teachers who are re-entering the system; (3) holdover teachers from the preceding year; and (4) immigrants into the system. This decomposition of the stock of teachers in year t can be expressed in the form $T(t) = N(t) + R(t) + C(t) + I(t)$, where the terms represent the counts of new, re-entering, continuing, and immigrant teachers in year t . Each of the four terms on the right can be thought of as "takes" from four stocks of potential teachers in year t . The new teachers can be thought of as coming from the teacher pipeline in year $t - 1$; the re-entrant come from the reserve pool of former teachers; the continuing teachers come from the stock of teachers at the start of the preceding year; and the immigrants come from the stock of teachers outside the system who are potential immigrants into the system. Note that if the system under consideration consists of teachers in a particular field (say, mathematics), the

immigrant category would include those who shift over from other fields while remaining in the same school. Since field-shifting of this type is often done piecemeal (e.g., by having an erstwhile science teacher teach two sections of algebra), there are some important definitional problems associated with these categorizations that need to be solved in planning surveys to fathom this source of teacher supply. The key point emerging is that since "teacher supply" is a fuzzy concept it is critical before undertaking projections of teacher supply to clearly decide what the term "supply" includes.

Although the meaning of the expression "teacher supply" is vague, there is substantial agreement as to what is meant by "teacher demand." The demand for teachers in year t , denoted by $D(t)$, is ordinarily defined as the number of new teachers added that year, $T(t) - C(t)$, plus the "unmet demand" $U(t)$, which is the number of positions for which candidates were sought but none were hired. Thus,

$$D(t) = T(t) - C(t) + U(t).$$

Letting $G(t)$ denote the growth $T(t) - T(t-1)$ in the teacher force from year $t-1$ to t , and letting $L(t)$ denote the losses $T(t-1) - C(t)$ resulting from turnover between years $t-1$ and t , we observe that the demand for additional teachers in year t can also be expressed in the form

$$D(t) = G(t) + L(t) + U(t)$$

The main uncertainty in defining demand is associated with the notion of unmet demand or "shortages." Certain states may argue that unmet demand does not exist ("supply equals demand") because of the flexibility that school administrators have in hiring marginally qualified teachers, reassigning teachers to fill vacancies, changing course offerings, modifying class sizes, or relying on part-time, substitute, or itinerant teachers (Haggstrom et. al, 1988).

The growth component of demand, $G(t)$, can be decomposed into two parts—one associated with enrolment growth $E(t) - E(t-1)$ between year $t-1$ and t , and a second component associated with the year-to-year change in the teacher/pupil ratio $R(t) = T(t) / E(t)$. To facilitate defining these two components precisely, one can express the growth in teacher force $G(t)$ in other forms as follows:

$$\begin{aligned} G(t) &= T(t) - T(t-1) = R(t)E(t) - R(t-1)E(t-1) \\ &= [R(t) - R(t-1)]E(t) + R(t-1)[E(t) - E(t-1)]. \end{aligned}$$

The growth components of demand are projected by substituting projected values of teacher/pupil ratios, $R(t)$, and projected values of enrolments, $E(t)$, in the last expression for $G(t)$ listed above. The projected values of the teacher/pupil ratios are estimated using four equations (one for each level/sector combination) of the form

$$R(t) = 0.5c + 0.5(a + bt).$$

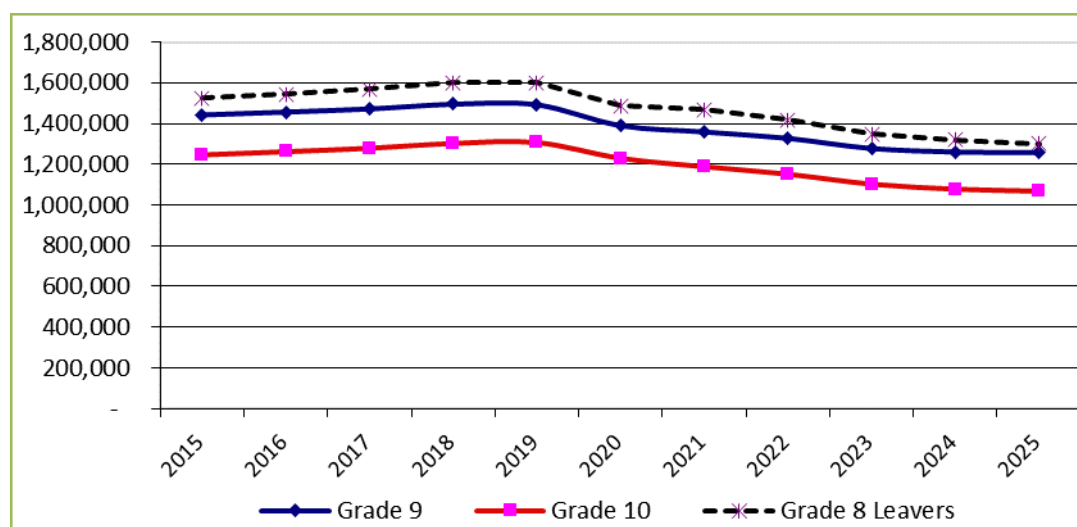
The constants c for the four equations are chosen to accord with the most recently observed values of $R(t)$, and a and b are regression coefficients for equations fitted using exponential smoothing. This amounts to choosing projected values of $R(t)$ that are midway between Centre for Education Statistic's other projections— the "low projections" for which the projected values of $R(t)$ remain constant at c , and the "high projections" that accord with linear extrapolation based on past trends (Haggstrom et. al, 1988).

2.4.2 Feasible GER growth model

Certain projection models adopt a feasible growth model which incorporates intakes rates, repetition, promotion and dropout rates as well as changes in demographic structures to project demand for secondary schooling and the GER for the secondary education. An enrolment driven projection analysis was undertaken by the RMSA-Technical Cooperation Agency (RMSA-TCA) team to determine demand for secondary schooling in Madhya Pradesh (RMSA-TCA, 2015). The RMSA-TCA's Enhanced Projection and Simulation Model uses data from UDISE, from reconstructed cohort analysis and from state-level statistics to generate a feasible enrolment growth model populated with the most recent data on enrolments, teachers, schools, classrooms and costs. The feasible growth model is validated using various tests of internal consistency and external validity with key parameters derived from other sources.

The figure 2 below presents changes in the enrolment pattern at the elementary and the secondary level for the period 2015-2025 in Madhya Pradesh. In 2015, class 8 leavers are expected to be around 152473, increasing to 1601602 by 2019 before declining to 1301219 by 2025 (Figure 2). Similarly, demand for grade 9 and grade 10 will increase from 2687985 in 2015 to 2908223 by 2019 before declining to 2368951 by 2025. The resulting GER, in this model, is projected to increase from 74.7 percent in 2015 to 89.5 percent by 2025.

Figure 2: Projections for student enrolment in secondary



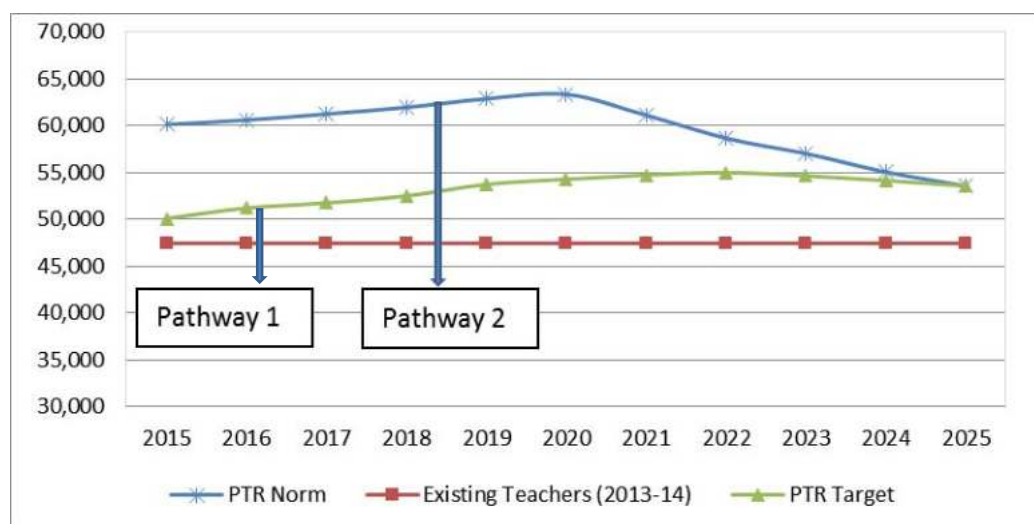
Source: TCA projection model

The demand for total number for teaching staff in government system has been determined using the projected demand for secondary places and applying a pupil-teacher standard of 30:1². Two different pathways for converging to this norm level of staffing (30:1) from an existing PTR of 36:1 are shown in figure 3. Pathway 1 represents a gradual change in the existing PTR level with the aim of convergence to norms standard over a period of 10 years. The total demand for teachers is determined by the movement in number of students. Using this pathway 1, in 2015 the demand for government teacher is estimated to be 50095 it increases to 54998 by 2022 before reaching 53558 in 2025, at the point of convergence with norms requirement. Pathway 2 represents an immediate

²While this is an optimal scenario, alternative scenarios would require clarity in terms of the minimum school size policy of the state government, distribution of schools by size and incorporation of any exemptions in terms of school size and staffing.

change in number of teachers required to converge PTR to the norms standard. It shows the initial number of teachers required to reach norm level would be significant and then, the state would also need to release more teachers as enrolment begins to decline. In this model in 2015, the gap between the estimated number of teachers and the number of teachers required to reach norm level is about 13000 teachers. According to the model, the teacher demand will be 60113 in 2015 then rising to 63343 in 2020 before declining to 53558 in 2025. Pathway 1 seems more implementable than Pathway 2 where significantly more resources are required based on the number teachers needed immediately.

Figure 3: Projected teacher demand



Source: TCA projection model

2.4.3 NCTE Study Model

The National Council for Teacher Education (NCTE) published a study for various states in India in 2010 titled *Demand and Supply Estimates of School Teachers and Teacher Educators (2007-08–2016-17)* (NCTE, 2010). The parameters utilised by the study included projected school age cohort (5-17 years), teacher –pupil ratio, provisioning of one and a half teachers per additional section as minimum requirement due to subject-specific considerations at secondary and senior secondary stages, attrition rate of teachers and backlog in demand due to existing vacancies. This report estimated the demand for additional teachers at elementary, secondary and senior secondary level until 2016-17 on the basis of additional enrolment, PTR, three percent teacher attrition, the existing strength of teachers and the numbers of teachers required to reduce the backlog (vacancy and untrained teachers) as well as teaching load per teacher at secondary level.

Net Demand for = Teachers in a given year	Additional Demand for Teachers based on additional subjects offered in a given year + Replacement of retiring teachers as per stated attrition rate + backlog in demand for teachers due to existing vacancies and untrained teachers.
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The projections were made in terms of additional enrolment, sections and thus additional teachers required. At secondary stage (Classes IX-X) the formulation for estimating additional demand for teachers was the following:

Additional Demand for Secondary teachers =	Projected Additional Enrolment for a given year X weekly period (48) X 3*
	PTR (1:25) X Teaching Load per teacher (32) X 2

*The additional sections based on the additional projected enrolment have been multiplied by a factor of 2.25 based on the above formulation

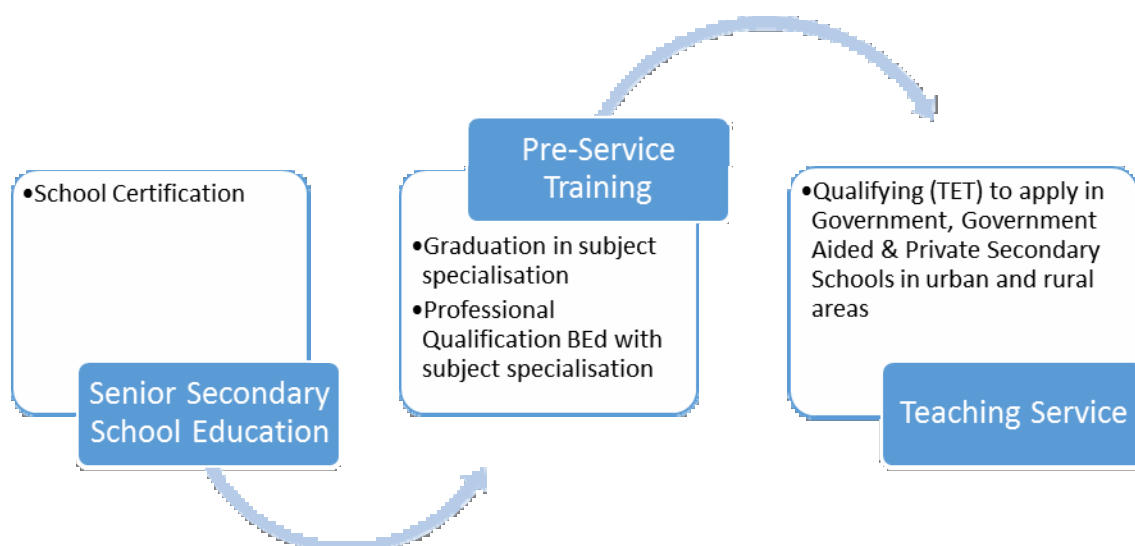
However the RMSA-TCA reviews found that in 2013-14 the enrolment was significantly lower than the projections (RMSA-TCA-Karnataka, 2015; RMSA-TCA-Madhya Pradesh, 2015). This model may need to be reconsidered since secondary school vacancies are linked to specific subject teachers, rather than PTR and fresh projection would be required keeping in view vacancies of subject teachers and school populations at secondary level.

3. Methodology and Data

Forecasting and projecting demand and supply of subject teachers at secondary level is a complex matter and requires consideration of the population projections of secondary school populations, the number of teachers being trained annually and various external factors. In order to analyse some of these factors, this study utilises mixed methods research for studying demand and supply so that both quantitative and qualitative approaches would inform this study. A combination of qualitative and quantitative methods allow for a more robust analysis, taking advantage of the strengths of each. While the quantitative data provides a situational analysis related to the number of subject teachers needed and trained each year, the qualitative research supports in-depth analysis of the factors behind the phenomenon and the effect of the same on schools and teaching-learning process.

The secondary teacher supply pipeline (Fig 4) consists of senior secondary school leavers entering an undergraduate course in a specific subject stream such as Science or Humanities and then undertaking a post graduate teacher education course, B.Ed., taking up two methods paper/s linked to their undergraduate subject.

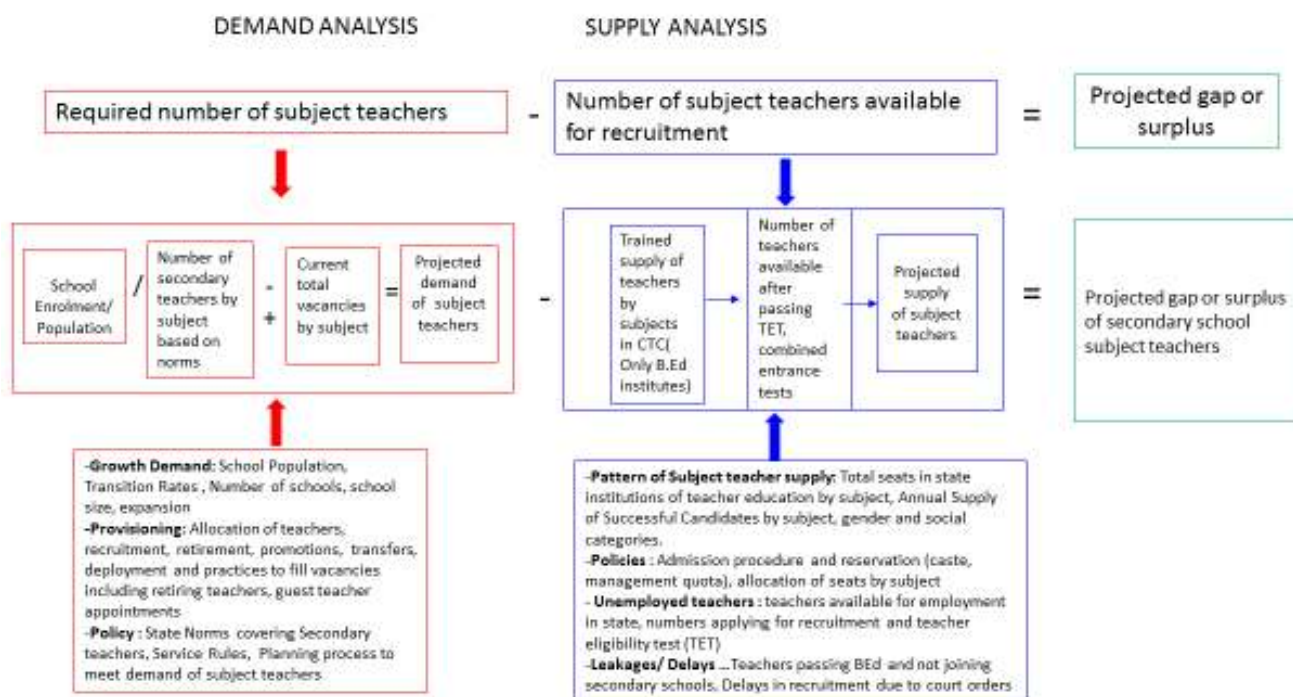
Figure 4: Teacher Supply Pipeline



3.1 Analytical Model

The model (Fig 5) below summarizes the data that informed the study. The demand side is influenced by the factors such as growth or reduction in secondary school student population, choice of subjects offered by secondary schools, current and future vacancies by location (urban and rural) and school type (private, government and government-aided), based on teacher retirement, attrition and secondary school expansion. The supply side of secondary school subject teachers is dependent on the number of teachers trained by subject and ready to take up teaching jobs particularly in rural and remote areas.

Figure 5: Demand and Supply Analytical Model



Adapted from: Workforce Planning Tool Kit: Supply/Demand Analysis and Gap Analysis, 2007, CPS Human Resource Services

3.2 Data Sources

3.2.1 Demand Side Data

Secondary data related to subject teacher availability provided by the state governments of Karnataka and Madhya Pradesh and UDISE data for 2014-15 informed the analysis. Teacher demand was analysed with information related to the number of subject teachers currently employed in government, private unaided and aided schools for secondary grades, their academic and professional qualifications, appointment status (regular or contract), age of retirement, gender and social categories as well as existing vacancies. As a method of qualitative research, Key Informant Interviews with teachers located across three districts in both Karnataka and Madhya Pradesh as well as District and State officials were conducted to substantiate the quantitative analysis of subject teacher shortage (if any) and provide insights as to how schools deal with subject teacher shortages.

3.2.2 Supply Side Data

We realise that teacher supply and demand at secondary level may be confused due to inadequate data related to pre-service teachers availability by subject. No data base of teachers trained in various colleges of education, based on the subject specialisation is available. Therefore the study needed to collect this data either directly from the colleges or from the universities to which these colleges were affiliated.

For the supply side analysis, primary quantitative data was collected regarding subject teacher availability from Colleges of Teacher Education (CTEs) through a questionnaire posited to all the

CTEs in the state. This provided insight into the number of candidates being admitted and successfully completing B.Ed. by subject in both government and private CTEs. In Karnataka the tool for capturing this data was uploaded on the Higher Education website and almost 65 percent of colleges responded and provided information online. To increase the response rate, the RMSA research team visited each of the 12 universities to get information about successful candidates completing B.Ed. from the affiliated colleges. We finally got supply side information from 281 CTEs (86.4 percent) out of a total of 325 affiliated teacher education colleges in the state of Karnataka for the session of 2013-14.

In Madhya Pradesh supply side data was gathered through a questionnaire sent to all the colleges of education. The response rate was very low and it was decided to send field investigators to each of the seven universities (Annexure J) that had affiliated B.Ed. colleges in the state. 100 percent information from all universities was gathered regarding candidates being admitted and completing B.Ed. by subjects for the past three years. 2013-14 was a year when no courses were held due to a court order and we utilise data for 2012-13 for the supply side analysis of MP.

The above information was further supplemented by qualitative research in terms of Focus Group Interviews with teacher trainees and Key Informant Interviews with Principals of colleges of education located in Karnataka and MP.

3.2.3 Tools developed

Besides the quantitative data capture formats developed for gathering subject teacher availability at school level in Karnataka and Madhya Pradesh, the supply side format to gather information about number of teacher trainees enrolled and passed in teacher education institutes in the two states were developed. In addition, five interview schedules and one focus group discussion guideline tools were also prepared (Annexure A-H) by the TCA research team. The tools primarily attempted to capture information about perceptions of demand and supply of subject teachers, shortages and associated policies and provisions in the two states. These were as follows

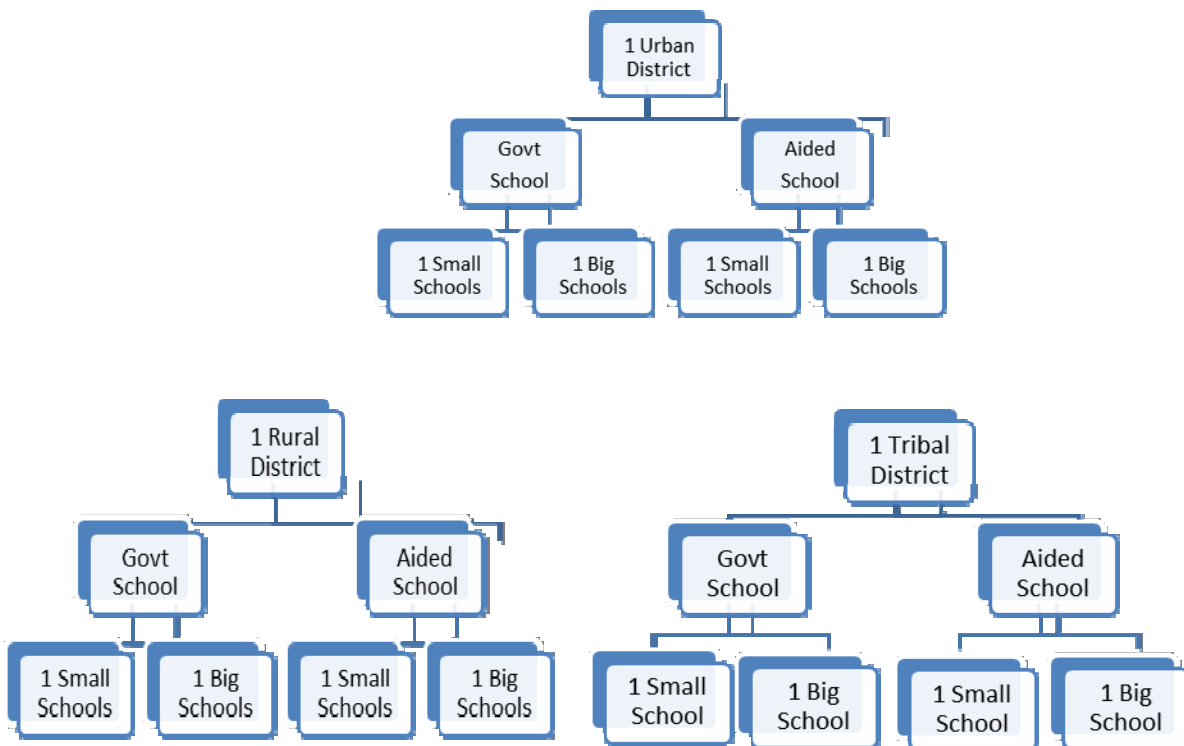
- Interview protocols for state officials of Secondary and Higher Education department
- Interview Protocol for State District Officials
- Interview protocol for CTE Principals
- Interview Protocol for School Principals
- Interview Protocol for Secondary School Teachers
- Teacher Trainees Focus Group Interviews

3.3 Sampling for Qualitative Research

In order to gather qualitative data from the two states related to the demand and supply, three districts which represented an urban, a rural and a tribal dominated district were purposively chosen in each of the states. The rationale for choice of districts and details of districts is given below.

The demand side data was collected from a nested sample of 4 schools government and aided (big and small schools) in the three sample districts of both Karnataka and Madhya Pradesh (Fig 6).

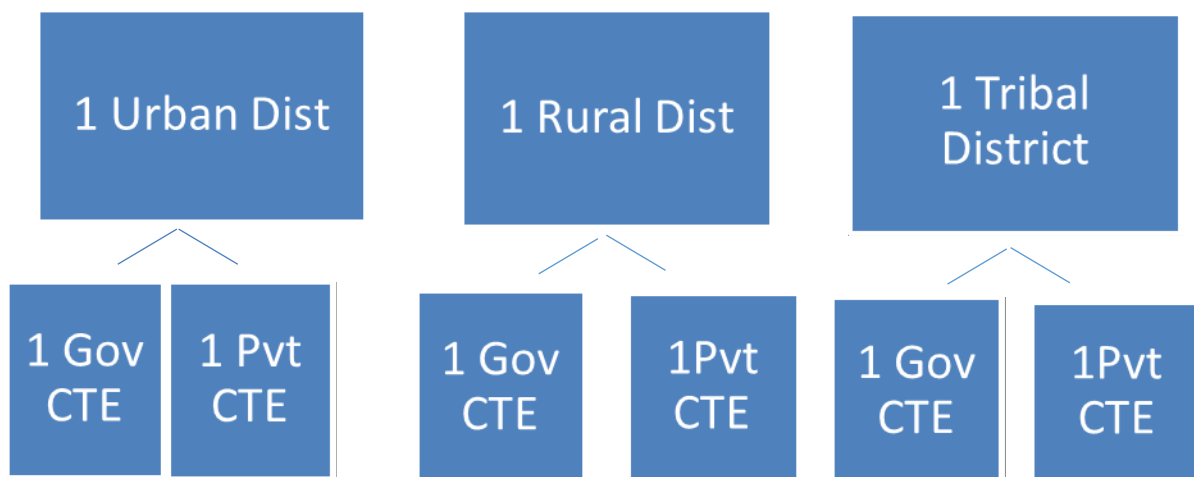
Figure 6: Qualitative Sample of Demand of Secondary Teachers



Data for the demand side was collected from twelve schools each in the two states. Two government and two aided schools were chosen from an urban, rural and a tribal district of the two states. The criterion of the selection of the two government schools and two government aided schools was based on size of student population. A district level education officer was interviewed from each district and at the state level the Commissioner RMSA was interviewed.

Qualitative data was also collected from the three districts in the states of Karnataka and Madhya Pradesh for information on the supply side (Fig 7). In each of the three districts interviews were conducted in teacher education institutes – government and private.

Figure 7: Qualitative Sampling of Supply of Secondary Teachers



3.3.1 Sample Districts & Rationale- Karnataka

In **Karnataka**, the three sample districts consisted of one urban (Dakshina Kannada), one rural (Hassan) and one district with a tribal population (Chitradurga). Dakshina Kannada district comprises of 215 panchayats and 114 clusters and has the second largest urban population. Hassan is one among the districts which has highest rural population. Hassan comprises of 8 talukas/blocks and 258 villages. Chitradurga has the highest tribal population in the state. Basic demographic profile of the districts according to the Census 2011 is as follows:

	Dakshina Kannada	Hassan	Chitradurga
Population	996086 urban population	1399658 rural population	1329923 rural population
			Total tribal population 266235
	493230 males	695583 males	675573 males
	502856 females	704075 females	654350 females
	47.7 percent live in urban regions of district	78.8 percent population live in rural areas of villages	80.1 percent live in rural areas of villages
			17.5 percent of total population is tribal
Sex Ratio	1020 in urban areas	1012 in rural areas	969 in rural areas
Literacy rate	92.1 percent	72.8 percent	70.7 percent
	Male - 95.5 percent	Male - 81.4 percent	Male - 79.8 percent
	Female - 88.8 percent	Female - 64.3 percent	Female - 61.9 percent

Schools in Three Sample Districts of Karnataka (Management Wise)

District	Government and Aided	Private	Total enrolment in secondary
Dakshina Kannada	299	240	71517
Hassan	408	125	51887
Chitradurga	233	93	50245

Source: UDISE 2014-15

CTE in Three Sample Districts (Management Wise)

District	Government and Aided	Private	Total seats
Dakshina Kannada	2	11	1300
Hassan	4	5	900
Chitradurga	1	12	1300

From each of these districts one government and one private teacher college was identified for conducting interviews. The Secretary for Higher education and the NCTE Regional Committee Director was interviewed as well.

District	Management Type	SUPPLY		DEMAND		
		CTE Principal	Teacher Trainees	School Size	School Principal	Teachers
Dakshina Kannada -Urban	Government	1	8	Large	1	1
				Small	1	1
	Private Unaided	1	8	-	-	-
	Government Aided	-	-	Large	1	1
Small				1	1	
Hassan -Rural	Government	1	8	Large	1	1
				Small	1	1
	Private Unaided	1	8	-	-	-
	Government Aided	-	-	Large	1	1
Small				1	1	
Chitradurga -Tribal Dominated District	Government	1	8	Large	1	1
				Small	1	1
	Private Unaided	1	8	-	-	-
	Government Aided	-	-	Large	1	1
Small				1	1	

3.3.2 Sample Districts & Rationale -Madhya Pradesh

In **Madhya Pradesh** the three sample districts consisted of one urban (Bhopal), one rural (Chhatarpur) and one tribal district (Jhabua). The districts were selected to represent different geographical areas of the state. Bhopal which is the capital of Madhya Pradesh has two rural blocks and 525 panchayats and a population density of 855 per sq. Km. The Jhabua District has 6 blocks and 832 village panchayats. All the blocks in the district are tribal blocks. According to the Census 2011 the three districts have the following demographics:

	Bhopal	Chhatarpur	Jhabua
Population	urban population 84 percent	Rural population 78 percent.	highest tribal population 86.8 percent
			69 percent rural population.
	2371061 total population	17623751 total population	1025048
	1236130 male	936121 male	
	1236130 female	826254 female	
Sex Ratio	918 per 1000	883 per 1000.	990 per 1000.
Literacy rate	80.4 percent	63.7 percent	43.3 percent.

The number of schools in the sample districts chosen for the qualitative survey by management are listed in the table below.

Schools in Three Sample Districts³ (Management Wise)

S.No.	District	No of High Schools			No of Higher secondary Schools		
		Government	Aided	Private	Government	Aided	Private
1	Jhabua	71	01	30	40	01	13
2	Bhopal	41	3	176	59	06	376
3	Chhatarpur	73	00	83	84	05	83

The districts were also chosen as they had colleges of education affiliated to three different universities in the state. There are 553 CTEs (NCTE recognized) as per list of WRC Bhopal published on 9/09/2015. Out of the 67 CTEs of Bhopal, four are government or government aided. Only one is run by the Government and is called Institute of Advanced Studies in Education. The other three are aided institutions - education department of Barkatullah University, Bhopal; Bhoj University (having 12 Study Centres and 1000 seats) and Rashtriya Sanskrit Sansthan, Deemed University. The number as reported by the team, fluctuates every 2-3 months. Bhopal and its surroundings have more than 80 private CTEs and they are all affiliated to Barkatullah University, Bhopal. Jhabua district has no government CTE but has two private CTEs affiliated to DAVV (University) Indore and these were taken up for the qualitative research. The CTEs of Chhatarpur are affiliated to Dr. Hari Singh Gour University Sagar.

CTE in Three Sample Districts (Management Wise)

District	Government and Aided	Private	Total
Bhopal	4	63	67
Chhatarpur	1	31	32
Jhabua	0	2	2

From each of these districts one government and one private teacher college was identified for conducting interviews except Jhabua in Madhya Pradesh which did not have any government CTE. An official from higher education and the Director Regional Committee NCTE were interviewed as well. Data for the demand side was collected from twelve schools in the state. Two schools each were chosen from one urban, one rural and one tribal district of the states. In each of the districts two government schools and two government aided schools (big and small based on student population) were identified. A district level education officer was interviewed from each district and at the state level the SPD RMSA and Joint Director RMSA were interviewed.

District	Management Type	SUPPLY		DEMAND		
		CTE Principal	Teacher Trainees	School Size	School Principal	Teachers
Bhopal - Urban	Government	1	8	Large	1	1
				Small	1	1

³ In Bhopal additional data came Central Schools HSS=6 including 1 navodaya, tribal deptt school (Govt) HS1 and HSS 1, Madarsa Board HS 1 and HSS1 Madarsa Board school can be treated as aided private

	Private Unaided	1	8	-	-	-
	Government Aided	-	-	Large	1	1
				Small	1	1
Chhatarpur -Rural	Government	1	8	Large	1	1
				Small	1	1
	Private Unaided	1	8	-	-	-
	Government Aided	-	-	Large	1	1
Small				1	1	
Jhabua -Tribal District	Government	-	-	Large	1	1
				Small	1	1
	Private Unaided	1	8	-	-	-
	Government Aided	-	-	Large	1	1
Small				1	1	

3.4 Research study plan and timelines

The study was conducted in three phases. In phase one the TMD Review was presented to the two states and their consent and collaboration in the TDS Study established. The proposal was also shared with National Council of Teacher Education and Secretary, School & Literacy, Ministry of Human Resource Development, who approved the study and hoped that the tools would also be helpful for the larger teacher supply and demand study that NCTE was planning to undertake across all levels of education and states/UT's of India. After finalisation of the study plan including the modalities of data collection and field investigators engagement, data capture formats and tools were developed and field investigators were trained in a two-day workshop regarding data collection, for example conducting focus group interviews as well as writing transcripts and summaries. The tools were translated into Hindi and Kannada and field investigators were also provided inputs regarding research ethics including getting written consent forms from all respondents. Phase two focused on data collection and phase three focused on data analysis and reporting.

Research team

Besides the core research team at Delhi, two state level teams were appointed. In both MP and Karnataka the state team comprised of two teams with a research associate and research supervisor, who collected the qualitative data. Field investigators were further employed to collect the quantitative supply side data from the universities in each of the states

Data Analysis

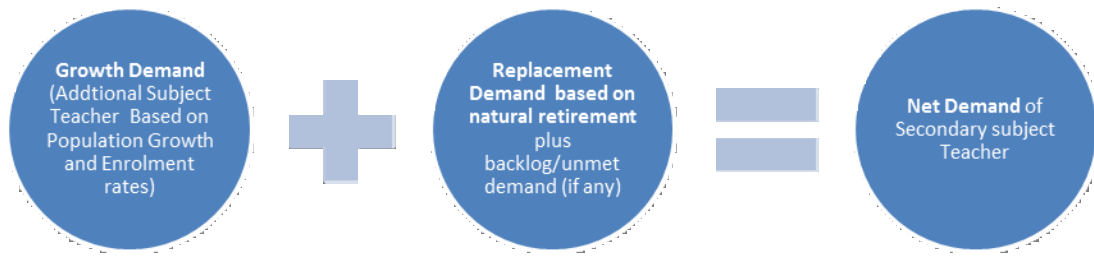
Qualitative data transcripts were digitalised and coded for primary and thematic codes. Quantitative data was analysed through SPSS.

3.5 Demand and Supply Projection Model Adopted by this Study

The model utilised in this study includes population and secondary school enrolment growth. This information is drawn from the demographic projections of children aged 13-15 in Karnataka (since we analyse Grades VIII-X) and children aged 14-15 years in Madhya Pradesh and a projection of secondary school enrolment population. Since secondary school demand and supply requires calculation of subject teacher availability, in this study the projections of teacher demand are made on the basis of 2014-15 additional teachers required in five core subject teachers (two languages, one Science, one Social Studies and one Mathematics teachers). We have also utilised teacher demand based on school size drawn from the number of sections within secondary schools within the two states of MP and Karnataka. In MP this data was available for all schools, but in Karnataka the section data was only available for government schools. To calculate the net demand of secondary subject teachers, the growth demand is added to the replacement demand which was based on actual figures of superannuating teachers expected between 2015- 2024. This data is drawn from calculating the retirement of current teachers drawn on the basis of the appointment date of all teachers in the state, instead of aggregate data. The underlying assumption for the projection is that all the conditions other than population and enrolment growth will remain the same.

The steps of the projection calculation as follow;

1. The number of schools without core subject teachers are identified by subject in the states for the base year 2014-15.
2. According to the number of sections in a school, the number of additional teacher required is calculated following the state norms for sanctioning additional teachers.
3. This calculation is doubled for the projection of Language teacher demand, since secondary schools require at least 2 languages in their curriculum.
4. Once the demand for 2014-15 is calculated by subject, the figures are extrapolated based on the GER growth rate projected in advance until 2024, considering population changes of the age group.
5. For replacement demand, the numbers of teachers who will be retiring in the years 2015-2024 are calculated based on the date of birth of teachers by subject. These figures are added to the subject teacher demand by subject.

Figure 8: Model Teacher Demand & Supply

3.6 Supply of Potential Entrants into Teaching Force

For the supply side predictions, our model takes into account the number of subject teachers trained by the two states and for this we draw upon the total number of teachers trained across all the teacher education institutes in Karnataka and Madhya Pradesh. We then link the shortage or surplus of subject teachers to the number of teachers being trained in the state, to analyse whether the state has sufficient or paucity of teachers.

4. Analysis of Teacher Supply and Demand in Karnataka

4.1 Context: Karnataka

Karnataka is one of the progressive states in southern India with a population of 6.1 crores (Census, 2011) accounting for 5.1 percent of India's population and occupying 5.9 percent of India's territory. The State's population has grown by 15.7 percent during the last decade. The state achieved a total literacy rate of 76 percent in 2011 with female literacy rates at 68 percent (Census, 2011). While the overall literacy performance of the State is encouraging, its regional and rural-urban disparities are a concern. Fifteen districts in the State show overall literacy rates, which are lower than the national average (74 percent) with Yadgir (52 percent) at the bottom. Kannada is the official language of Karnataka and spoken as a native language by about 65 percent of the people. Other language groups in the state include Urdu (9.7 percent), Telugu (8.3 percent), Tamil (5.4 percent), Marathi (3.9 percent), Tulu (3.4 percent), Hindi (1.9 percent), Konkani (1.8 percent), Malayalam (1.7 percent) and Kodava Takk (0.3 percent).

4.1.1 Secondary Education in Karnataka

In Karnataka, Class 1 to 10 is managed by the Department of School Education and Class 11 and 12, by a separate Pre-University Education Board ("Perspective Plan for Expanding Secondary Education" 2009-2017, Government of Karnataka). At the state level, there is a 'State Mission' of the RMSA called the 'Governing Council', headed by the Chief Minister. The 'Executive Committee' is the decision making body and is headed by the Secretary, Primary and Secondary education, Government of Karnataka and includes Commissioner for Public Instruction (Vice Chair Person) among others (Annex 3). At the district level, the Deputy Director of Public Instruction (DDPI) is responsible for all RMSA activities related to the planning, management and implementation of all components of the scheme.

According to the Perspective Plan for Karnataka's Secondary Education (2009-2017), the mid-term GER target at secondary level is 100 percent by 2017. Based on this target, enrolment at the secondary level is expected to increase from 1.6 million in 2008 to 2.1 million by 2017. Despite the Government of Karnataka's vision and efforts to achieve universal secondary education by 2017, the GER remains 81.8 percent in 2014-15, which is an increase from 77.5 percent in 2013-14. The Net Enrolment Rate in 2014-15 was 59.1 -an increase of 5 percent from 2013-14. While the transition rate from elementary to secondary education was a high 94.3 percent in 2013-14, the transition from secondary to senior secondary level was a low 45.7. Achieving universal secondary education faces another challenge in terms of retention levels, which was 84.7 percent in 2013-14- an increase of less than 4 percent since 2009.

4.2 Karnataka Supply and Demand of Secondary School Teachers

To make an assessment of teacher supply and demand it is necessary to understand the shortage or excess of teachers by subject at the secondary level. For the demand side analysis we have utilised the state data provided by Karnataka RMSA based on the demand side quantitative tool developed and also UDISE 2014-15. The supply side analysis is based on the primary quantitative data collected from Universities and affiliated colleges running B.Ed. courses in the state. The qualitative primary data collected from schools, teacher training

institutes and key stakeholder interviews provides deeper analysis to strengthen the quantitative analysis.

4.2.1 Demand of Secondary Teachers in Karnataka

4.2.1.1 School Enrolment Status

There were 13859 secondary schools in Karnataka in 2014-15, with a population of 2414082 students enrolled in Grades VIII-X. We have included student population enrolled in Grades VIII-X while doing the demand and supply analysis for the state, since Karnataka continues to have Grade VIII attached to secondary schools and teachers end up teaching all three classes.

Government and aided schools⁴ secondary schools (63 percent schools with 73 percent students enrolled) make up the largest group of secondary schools in Karnataka. Private unaided schools with secondary classes enjoy a much smaller share (36 percent schools with 27 percent students enrolled) (Table 2).

Table 2: Student Enrolment by School Types in Karnataka

Management type of Schools	Schools	Percent share	Enrolment	Percent share
Government	5114	36.9	960617	40
Private Aided	3739	27	800970	33
Private Unaided	4995	36	650805	27
Others	11	0.1	1690	0
Total	13859	100	2414082	100

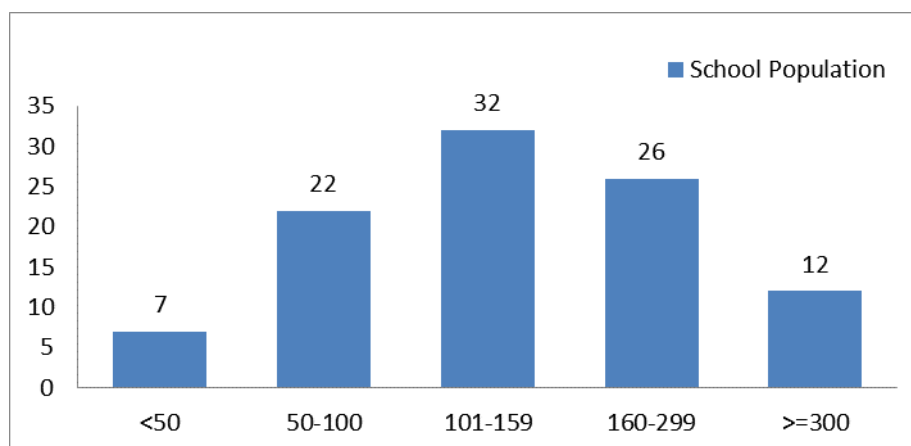
Source: Karnataka State Data 2014-15

RMSA staff norms require a minimum of 5 teachers and 1 head teacher for each secondary school with a minimum enrolment of 50 children in grades IX and X. To be cost efficient, schools with six staff should have at least 160 children enrolled if a norm for class size of 30 is observed. Current norms and standards do not differentiate free standing secondary schools from integrated schools with grades 1-10 or 6-10, 9-10, or 6-12 schools. In states such as Karnataka this becomes more complex, since Grade VIII remains an integral part of secondary schools and the number of subject teachers needs to be calculated for student population in Grades VIII-X. The demand for teachers was estimated based on the criteria that for every six sections (following the PTR norm of 1:30) of secondary classes a set of six core-subject teachers and for every 2 additional sections a set of two additional teachers would be required.

4.2.1.2 Secondary School by Secondary Population

To make an assessment of the demand of teachers at secondary stage it is essential to analyse schools based on student population in secondary classes. Fig 9 reveals that approximately 29 percent of the secondary schools have less than 100 students and 32 percent have a student population between 101-159. This means that around two thirds of the secondary schools are running below the efficiency level, enrolment size of 160 and below.

⁴ The state government pays for teachers in private aided schools, though they are privately managed.

Figure 9: Secondary School Student Population (percent)

Source: Karnataka State Data

Further analysis of school population by management (Table 3) reveals that private unaided schools have the highest number of small schools, with a total of 850 schools with less than 50 students, followed by government (92 schools) and aided (33) schools. It is evident that the private sector is running the largest number of very small secondary schools. This might not be a good news to those parents who select private schools as a better education option for their children.

Table 3: Number of Schools by Enrolment Size and School Categories

Management Type	Population of schools	Number of schools
Government	Less than 50	92
	50 to 100	932
	101 to 159	1827
	160 to 299	1585
	300 and above	678
Private Aided	Less than 50	33
	50 to 100	538
	101 to 159	1343
	160 to 299	1149
	300 and above	676
Private Unaided	Less than 50	850
	50 to 100	1643
	101 to 159	1217
	160 to 299	880
	300 and above	367
Others	Less than 50	2
	50 to 100	4
	101 to 159	2
	160 to 299	1
	300 and above	2

Source: State Data

As mentioned earlier, qualitative data regarding the demand side was only collected from government aided and government schools, and the smallest sized government schools in rural, tribal dominated and urban district had enrolment in classes VIII-X of 34, 32 and 35 students respectively. With 1 section each in Grade 8, 9 and 10th, it is clear that class size in these schools would be abysmally small. On the other hand, the largest aided school and the government school in the urban district had as many as 11 and 16 sections in 8, 9 and 10th and an average class size of 65 and 57 respectively (Table 4).

Table 4: Secondary School Population and sections in Secondary Classes

School Characteristics	Rural District				Tribal Dominated				Urban District			
Type of school	Aided (Small)	Aided (Large)	Govt (Small)	Govt (Large)	Aided (Small)	Aided (Large)	Govt (Small)	Govt (Large)	Aided (Small)	Aided (Large)	Govt (Small)	Govt (Large)
Total Students	99	273	34	103	112	455	32	266	35	720	73	917
No. of Sections in 8	1	2	1	1	1	3	1	3	1	3	1	3
No. of Sections in 9	1	2	1	1	1	3	1	3	1	4	1	6
No. of Sections in 10	1	2	1	1	1	3	1	3	1	4	1	7

Source: Qualitative Data, 2015

4.2.1.3 Teachers Availability by School Types in Karnataka

Given that mere PTR is not adequate to capture the demand of teachers, it is important to study the availability of subject teachers across schools of different managements in Karnataka schools. An examination of teacher availability by management reveals that government and government aided schools employ 68 percent of the teachers in the state, while they enjoy 64 percent of the enrolment. On the other hand, private unaided schools have approximately 32 percent of the teacher share, whereas their enrolment share is 27 percent. Clearly government and government aided schools have more teachers employed than private unaided schools at secondary level in Karnataka (Table 5).

Table 5: Teacher Distribution in Karnataka by School Management

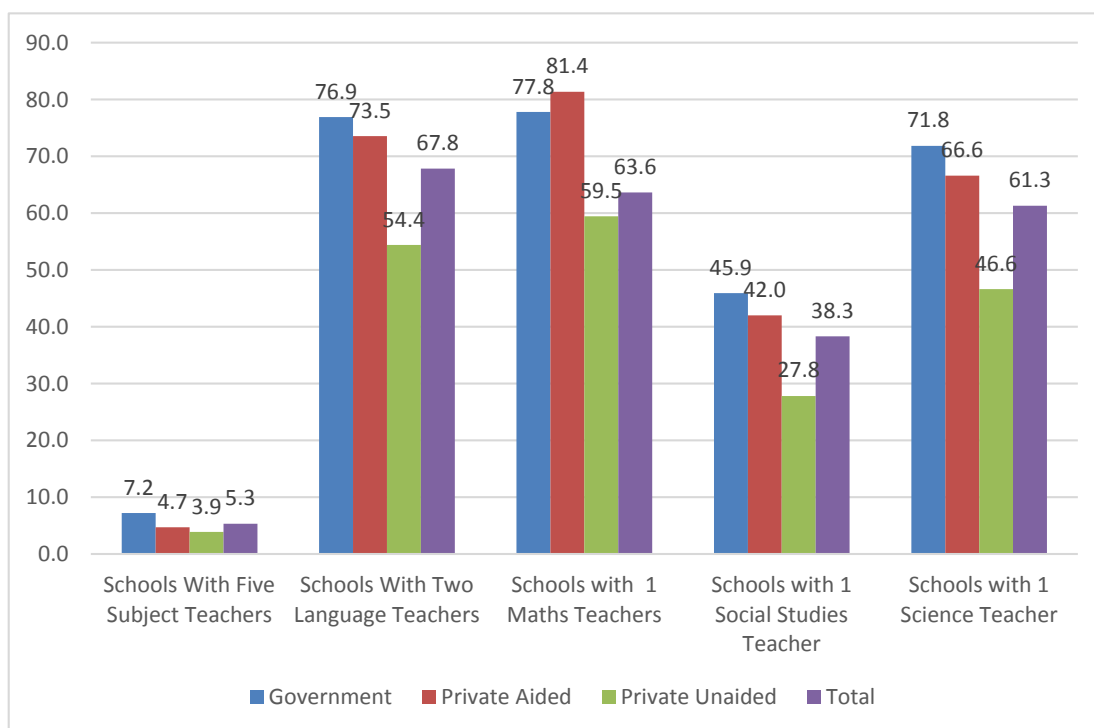
Management Type	Total Teachers	Percent
Government	43216	40.6
Private Aided	29226	27.5
Private Unaided	33729	31.8
Others	58	.1
Total	106229	100.0

Source: Karnataka State Data

4.2.1.4 Subject Teacher Availability

Since secondary schools must have a minimum of five subject teachers (2 language, 1 mathematics, 1 Science and 1 Social Studies), we analyse the status of subject teacher availability in the state within government, aided and unaided schools. As noted earlier 62 percent of secondary schools are small schools i.e. have less than 160 students in Classes VIII, IX and X. However the basic minimum of five subject teachers is essential.

Figure 10: Subject Teachers in Karnataka Schools by Management



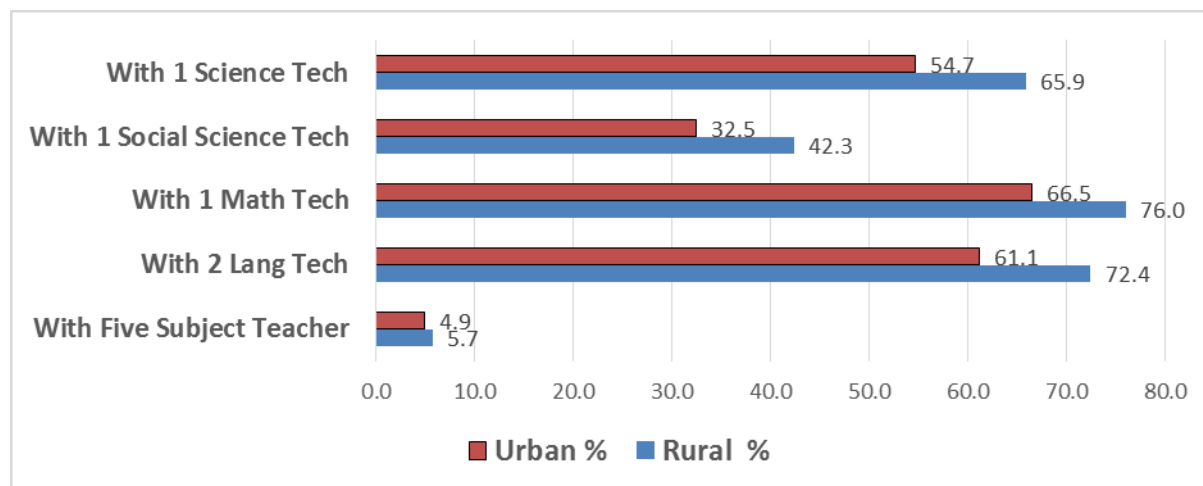
Source: Karnataka State Data

It is evident from Fig 10 (above) that less than 5.3 percent of all schools in Karnataka have 5 subject teachers with the highest number of five subject teachers found in 7.2 percent of government schools. In short there are as many as 13,118 schools without all five subject teachers, amongst which 4800 private unaided schools have the largest share, followed by 4744 government and 3563 private aided schools. However, while the minimum requirement of five subject teachers is clearly not found across majority of Karnataka schools, a large number of schools are seen to have presence of specific subject teachers. For example, 77 percent government schools have at least two language teachers, 72 percent government schools have at least one Science teacher, 78 percent government schools have at least one mathematics teacher and 46 percent government schools have at least one social studies teacher. Private unaided schools seem to have a huge paucity of subject teachers with only 55 percent schools with two language teachers, 60 percent schools with at least one maths teacher, 47 percent with at least one Science teacher and only 28 percent with at least one Social Studies teacher.

Overall 58.6 percent teachers belong to the rural areas and 41.4 percent belong to urban areas. Further desegregation of the data by urban and rural location reveals that rural schools are marginally better than urban schools with respect to availability of five subject teachers. With

respect to specific subject teachers rural schools fare better however the situation is not very promising across both locations and much needs to be done to improve the provisioning of five subject teachers (Fig 11).

Figure 11: Subject Teacher Availability by Location



Source: Karnataka State Data

Furthermore, distribution of teachers is not uniform and there also exists intra-state disparity in terms of subject teacher presence across the various districts of Karnataka (Table 6). While the district of Dakshina Kannada appear to be faring the worst with respect to all five subject teacher availability, the district of Udipi with 11 percent schools having the prescribed five subject teachers tops the list. Even in the best performing districts of Karnataka, only 53 percent of schools have 2 language teachers (Bangalore North), 49 percent have at least one mathematics teacher (Bangalore North) and 56 percent have a Science teacher.

Table 6: Districts with the highest and lowest percent of subject teachers

Teachers	Schools with lowest number of subject teachers		Schools with highest number of subject teachers	
	District	Percent	District	Percent
Schools with all 5 subject teachers	Dakshina Kannada	2	Udipi	11
Schools with at least 2 Language teachers	Dakshina Kannada	9	Bangalore north	53
Schools with at least one Mathematics teachers	Chamarajanagara	13	Bangalore north	49
Schools with at least one Social Studies teachers	Bidar	16	Tumkur Madhugiri	72
Schools with at least one Science teachers	Bangalore north	44	Tumkur Madhugiri	82

Source: Karnataka State Data

Given that almost 29 percent of schools have less than 100 students studying in Grades VIII-X, we analyse subject teacher availability by school population. Table 7 clearly shows that there are more teachers in schools with larger populations. While only 8 percent of schools with student population of more than 299 students have five subject teachers, however across all

categories of subject teachers it is evident that schools with larger student population have better provisioning of teachers.

Table 7: Subject teacher availability by School Size

School Size	Percent of schools with 5 subject teachers	Percent of schools with 2 language teachers	Percent of schools with 1 Maths teacher	Percent of schools with Social Studies teachers	Percent of schools with Science teachers
<50	2.4	40.9	53.8	26.6	38.4
50-100	1.4	61.1	67.1	34.8	54.0
101-159	5.6	68.8	71.7	40.1	63.1
160-299	5.4	74.3	77.6	39.1	66.7
>300	7.8	77.9	80.9	42.1	70.5

Source: Karnataka State Data

Subject teacher demand is evidently higher in schools with lower enrolment as seen in the above table. While five subject teachers are in short supply across all school sizes, there exists sizeable difference between schools with more than 299 students and those with less than 50 students. For example there is 37 percent point difference with reference to availability of 2 language teachers, and 16, 15.5 and 32 percent points with reference to mathematics, Social Studies and Science respectively. The analysis suggests that schools with more than 300 students are much more likely to have subject teachers, although all five subject teachers is available in less than 8 percent of even the larger schools.

The data captured from the interviews of three district officials representing rural, urban and tribal populated districts as well as interviews with principals of the 12 secondary schools (government and government aided), provides us further information about teacher shortage faced by schools and districts. Only 3.7 percent of all schools in the three sample Districts of Chitradurga, Dakshina Kannada and Hassan have all five teachers. Two of the district level officials (from rural and tribal districts) interviewed admitted to an imbalance existing between teacher supply and demand in the district but the third (belonging to the urban district) stated that there was no '*large scale shortage*' in the district. Bangalore North as seen in Table 6, has the largest number of schools in the state with at least two language and one Mathematics teacher.

In the sample rural districts chosen for the qualitative study, the imbalance was primarily reported in English, biology and Physics/Chemistry/Mathematics (PCM) teachers and it was pointed out that fifty eight schools in the district were in a need of English teachers. The official from the rural district also stated that there were shortages of teachers in Kannada language, but they were less in comparison to the shortages of English and PCM teachers. The district with tribal population had a shortage of 32 English teachers while the urban official pointed to a shortage for both English and PCM teachers. Clearly teachers for English in particular were in great short supply and this was also the case for Science and mathematics teachers in all three districts.

Out of the twelve principals interviewed across government and aided schools, eleven reported teacher shortage in their block/districts, while one principal did not feel s/he had enough information to comment. With regard to subject teacher availability at secondary level, shortages of English teachers was reported in nine schools and Kannada teachers in two schools, maths in five schools and Science teachers in six schools. In three school the principals stated that English (2 schools) and mathematics (one school) teacher posts had not been sanctioned. The interviews highlighted the shortage of English teachers, followed by Science and Mathematics teachers in the three districts. Since we were unable to desegregate language teachers by subject in the quantitative data, the paucity of English teachers as reported by the qualitative data is critical to emphasise.

Table 8: Teacher shortages in the district as reported by Principals

School type/size/district	Shortage	English	Mathematics	Science
Government small rural	Yes	Yes		
Government large rural	Yes	Yes		
Aided small rural	Yes	Yes	Yes	Yes-English Medium
Aided large rural	Yes	Yes	Yes	Yes-English Medium
Government large tribal	Yes	Yes	Yes	Yes
Government small tribal	Yes	Language(English and Kannada)		Yes
Aided large tribal	No info*			
Aided small tribal	Yes	Yes		
Government large urban	Yes	Language(English and Kannada)		
Government small urban	Yes	Yes		
Aided small urban	Yes		Yes	Yes
Aided large urban	Yes		Yes	Yes

* According to the transcript, the respondent teacher says they don't have authentic information regarding the subject teacher shortage in the district. On probing further they express that there may be shortage in science and English teachers, but proceed to saying they cannot give authentic information regarding this.

Source: Qualitative Data, 2015

4.2.1.5 Alignment between Teacher Appointments & Subjects Taught in Schools

It is important to analyse the subjects being taught by secondary teachers vis a vis their appointment to understand how many teachers may be teaching subjects they have not been appointed for. Since the Karnataka state data did not capture data related to appointments of teachers, we utilise UDISE data for this part of the analysis.

Analysis of appointment of teachers by subject as reported by UDISE 2014-15 for Karnataka reveals that almost 66 percent of secondary teachers in the state were appointed for teaching 'all subjects' (Table 9).

Table 9: Appointments of secondary teachers by subject

Appointments	Total Teachers	
	Frequency	Percent
All Subjects	70716	65.6
Languages	12553	11.6
Maths & Accountancy	5862	5.4
Social Sciences	6326	5.9
Science	5641	5.2
Others	6023	5.6
NA/missing	758	.7
Total	107879	100.0

- The “Others” category includes teachers of sports, health & physical education, music, fine arts, art education, philosophy and so on.

Source: UDISE Karnataka 2014-15

Though we do not have definitive reasons for this phenomenon, we can assume that a large number of teachers in this category may have been appointed as elementary teachers to teach ‘all subjects’ and later got promoted as secondary teachers upon completing their B.Ed. or equivalent. These teachers may still be categorised as ‘all subject’ teachers, since the data base may not have been updated over time. This argument is strengthened by the fact that around 32 percent of teachers in this category of ‘all subject teachers’ do not have B.Ed. degrees. While 18 percent of these teachers had B.El.Ed degrees, 6 percent of appointments for teaching ‘all subjects’ were found to have diploma/certificate level degree while another 8 percent had no degree mentioned in the state data.

Since these teachers were appointed to teach all subjects, further analysis of subjects that teachers are currently teaching finds that 16.2 percent of all secondary teachers are reported as teachers teaching ‘all subjects’ as their first subject (Table 10). This is extremely difficult to explain, since secondary school teachers are supposed to be B.Ed. teachers who can at best take up two methods papers in their teacher training course and therefore should be teaching only their specialisation subjects and should not be classified as ‘all subject’ teachers. While 16 percent of teachers fall under the category of teaching ‘all subjects’, 31 percent are teaching language, 7 percent Social Studies and 18 and 7 percent of total teachers are teaching Maths and Science teachers respectively.

Table 10: First Subject Being Taught by Secondary Teachers

Subjects	Total Teachers	
	Frequency	Percent
All Subjects	17527	16.2
Languages	33805	31.3
Maths & Accountancy	19148	17.7
Social Sciences	7957	7.4
Science	12015	11.1
Others	16841	15.6
NA/missing	586	0.5
Total	107879	100.0

Source: UDISE 2014-15

It is interesting to note that the further analysis of 17527 or 16 percent of teachers classified as teaching 'all subjects', are found mainly within private unaided schools (48.3 percent), followed by government (32 percent) and private aided (20 percent) schools (Table 11).

Table 11: Distribution of Teachers Teaching 'All Subjects'

Type of School	Frequency	Percent
Government	5362	31.7
Private Aided	3366	19.9
Private Unaided	8166	48.3
Others	16	.1
Total	16910	100.0

Source: Karnataka State Data

4.2.1.6 Retiring Teachers

As mentioned in the analytical model, it is important to estimate demand of teachers that will emerge as a result of teachers superannuating in the future. An analysis of the current secondary teachers by age cohort reveals that the majority of current teachers i.e. 64 percent belong to the age range 30-40 years. However, more than a quarter of secondary teachers are in the age group 50 plus and would retire over the next decade thereby causing vacancies to occur (Table 12).

Table 12: Age group of currently employed teachers

Age Group	Frequency	Percent
20s	7965	7.5
30s	36061	33.9
40s	32004	30.1
50s	24029	22.6
Age of 60	1686	1.6
Beyond 60	4484	4.2
Total	106229	100.0

Source: Karnataka State Data

Amongst this cohort of secondary teachers, Table 13 highlights that 59 percent of retiring teachers would belong to rural schools. Given the difficulties in finding teachers in rural areas this may be something to be looked into for future planning.

Table 13: Retiring Teachers by Location

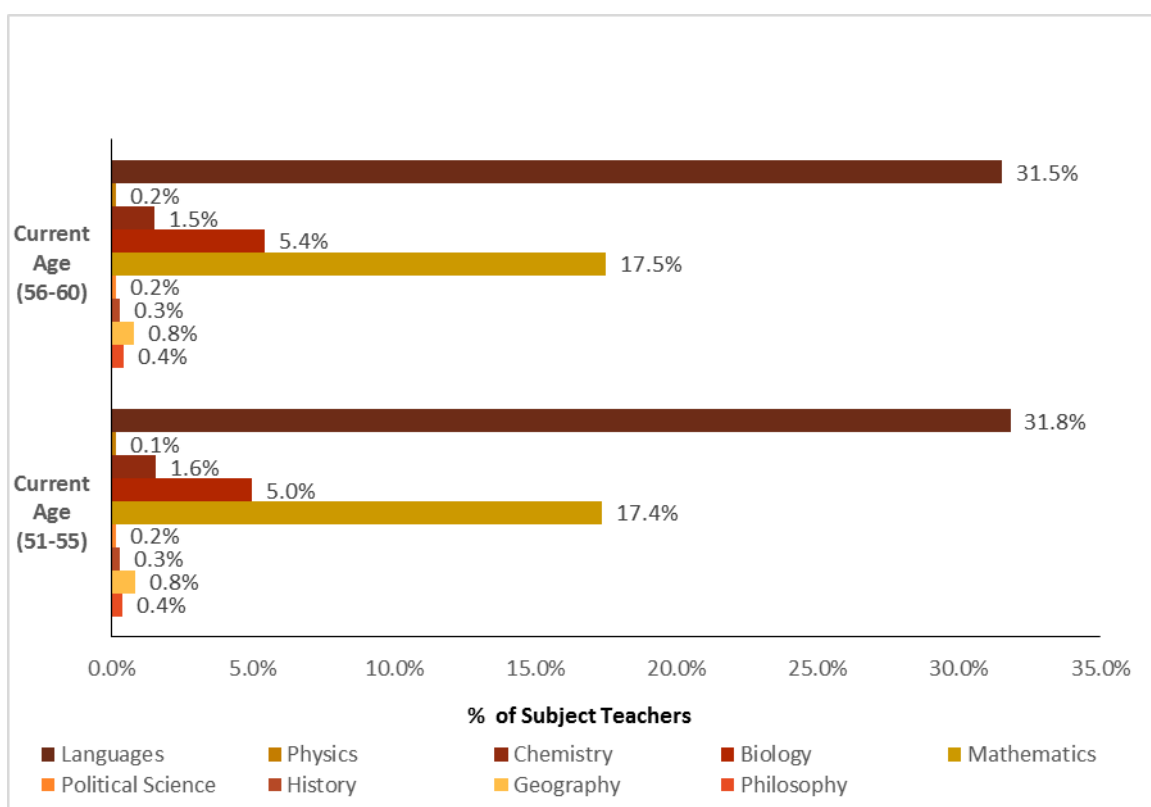
Age	Location		Total
	Rural	Urban	
51	1636	1218	2854
52	1588	1090	2678
53	1561	1065	2626
54	1544	1050	2594
55	1452	935	2387
56	1323	1017	2340
57	1303	910	2213

58	1164	839	2003
59	899	725	1624
60	956	730	1686
sum	13426	9579	23005
percent of total	58%	42%	100%
Total	62259	43970	106229

Source Karnataka State Data

It is also important to analyse which subject teachers would be needed based on the subject specialisation of retiring teachers. It is clear from Figure 12 that the majority of these will be language teachers, followed by maths and accountancy teachers. In short 19865 teachers would need to be recruited in the next ten years and these would be against existing sanctioned posts, majority being language and mathematics teachers in rural schools.

Figure 12: percent of Teachers Retiring in Next 10 Years by Different Subjects in Karnataka



Source: Karnataka State Data

4.3 Impact of Subject Teacher Shortage on Schools

The analysis regarding subject teacher availability has clearly illustrated that there exists an exceedingly small number of schools in Karnataka that meet the minimum requirement of 5 subject teachers for secondary classes. Before investigating the supply side issues, we look at how schools are impacted by this shortage through the qualitative data.

4.3.1 Quality of Teaching is Impacted

Five teachers (Aided rural-large & small; Aided large tribal; Government small-rural & urban) shared that the long term impact of teacher vacancy on students and teachers within schools. They stated that the quality of education was affected negatively and that this had a major impact on students learning. In the sample schools five out of the 12 principals reported that there was no difference between the B. Ed specialization of teachers and subjects they were assigned in schools. All teachers interviewed also confirmed they were teaching the subjects they had specialised in but a third of the teachers also reported that they were teaching subjects they had not specialised in (3 in aided schools –small urban, small tribal, large rural & 1 in government small rural). Teachers shared that many of them had to step in and teach subjects in which teachers were not available and one teacher specifically said that substituting teachers were not able to provide students comprehensive knowledge in those subjects. It is evident that schools manage shortage of subject teachers by asking existing teachers to substitute for the former, even though they lack content knowledge.

4.3.2 Discrepancy between Teacher Qualifications and Subjects Taught

The state data reveals that majority of teachers were qualified to teach secondary classes (Table 14), with approximately a third or 34 percent teachers not having B.Ed., which is the essential qualification to teach secondary classes. While about 6 percent of the teachers had a Diploma in Education qualifications and another 18 percent have B.El.Ed degree, which is the qualification for primary and upper primary school teachers and another 8 percent did not have the requisite qualifications.

Table 14: Teachers Professional qualifications

Professional Teaching Qualifications	Total Teachers	
	Frequency	Percent
B.Ed. or equivalent	69039	64.0
B.El.Ed	19586	18.2
Diploma/Cert <2 years	6560	6.1
M.Ed. or equivalent	3309	3.1
Diploma or Degree in Special Ed.	997	0.9
Others	4676	4.3
None	3700	3.4
Missing	12	0
Total	107879	100.0

Source: Karnataka UDISE 2014-15

In light of the large number of subject teacher vacancy and only 5 percent of schools in Karnataka having 5 subject teachers, it is apparent that teachers end up teaching subjects other than those they were appointed for. An analysis of the UDISE data regarding subjects taught and appointments found that only 20 percent of the teachers were engaged in teaching all subjects, though they were appointed in this category (Table 15). With regard to language teachers, about 83 percent of teachers appointed as language teachers were engaged in taking language classes, while 75 percent of teachers who were appointed for mathematics and accountancy, 58 percent of Social Studies and 76 percent of Science teachers were engaged in

taking classes for which they were appointed. This means that a large number of teachers were engaged in teaching other subjects and this may well be in the second methods subject they were trained in. Lack of accurate data providing this detailed information in UDISE about teacher specialisation subjects, does not allow further analysis, but needs to be investigated.

Table 15: Percent of Teachers by Teaching Subjects & Appointments

Appointment	Subjects Taught (Percent)						
	All Subjects	Languages	Maths & Accountancy	Social Sciences	Science	Others	NA/missing
All Subjects	20.5	30.5	18.8	4.8	9.5	15.8	0
Language	6.1	82.8	2.8	4.2	1.6	2.5	0.1
Maths & Accountancy	4.6	5.4	74.6	2.1	9	4.2	0.1
Social Sciences	17.5	12.4	7	57.6	2.4	3.1	0
Science	4.8	5.3	8.5	1.8	75.5	4.1	0
Others	6.8	6.7	3.1	2.8	2.6	77.9	0.1
Missing	22.8	2.5	0.5	0.4	0.7	0.7	72.4

Source: UDISE 2014-15

During the qualitative interviews, the teachers expressed the difficulty of teaching subjects without specialization. A teacher from an aided school expressed that in many aided schools there was no appointment of English teachers (with an English major), and Arts teacher with a background in History and English are appointed as English teachers. Two teachers who were teaching English, as there was no sanctioned post for English in the school, expressed that lack of training in English made it difficult to teach phonetics and poems in English. The lack of sanctioned posts for English teachers was also highlighted by state officials who said that they were hoping to get these posts sanctioned in the near future to improve quality of English teaching.

One teacher (trained in History and English in B.Ed.) had been asked to teach science for some time. While one teacher who was trained in history was teaching subjects like civics, economics, geography, business studies which were included in social science, another teacher trained in geography was also teaching history and maths. The teacher who was asked to teach maths when there was no maths teacher in the school, stated that it was very difficult to manage the content of this subject. Clearly, the discrepancy between teacher specialisation and classes assigned to teachers is an issue of contention in schools that needs to be addressed.

4.3.3 Teacher Workload

Given that teachers have reported teaching subjects other than their specialisation, teacher workload is an obvious concern. It is important to note that in Karnataka majority i.e. 96 percent of the secondary teachers in Karnataka are observed to be teaching secondary classes of eight, ninth and tenth only (Table 16.). Only a small fraction of the teachers were teaching

elementary classes or higher secondary students. This is important, since demand of teachers must also take into consideration workload of teachers.

Table 16: Secondary Teachers by Schools

Type of School	Percent
Secondary Only	96.1
Upper Primary & Secondary	2.2
Secondary & Hr Secondary	1.7
Total	100.0

Source: UDISE 2014-15

4.3.3.1 Increased Workload

According to the norms the number of classes that should be assigned to a teacher should be 28 classes per week. If the number of classes assigned exceeds this norm, the government sanctions another post. Karnataka has also developed a schedule for secondary classes Table 17 shows the number of periods each subject teacher is assigned if there are only 3 sections i.e. one each in Grades VIII-X.

Table 17: Assigned Classes by Subject

Subject	Number of Periods per week (Grades VIII-X)
Kannada	18
Mathematics	19
Social Studies	18
Science	18
English	15
Hindi	12
Library	3
Physical Education	12
Art	3

Source: Karnataka State Data

It is evident that teachers in small schools will have workload below the prescribed 28 classes if a secondary school has only one section for Grades VIII-X, however one also needs to take into consideration the fact that many of these teachers may also be substituting teachers who are not appointed for specific subjects. Forty percent of the teachers interviewed also shared that their workload had increased manifold due to teacher shortage. Interestingly, fifty percent of sampled principals felt the workload of teachers was appropriate, while others (primarily aided school principals) were concerned about the teachers' workload. However, they also said that there was no uniformity in the number of classes taken by teachers in the school.

The qualitative interviews captured the number of classes taught by teachers as reported by principals and teachers. Classes taken per week ranged from 16 to 35 per week according to the principals and 15 to 36 according to the teachers. However, the principals tended to report the heavier workload of teachers than the teachers' actual teaching-load. Two principals from (urban - government large & aided small) felt the imbalance in the workload was creating a negative effect on the quality of teaching learning process in the school (Table 18). Teachers in

government aided schools also reported that sanctioned posts were not given to the school, if there was a shortage of teacher for 12 periods, which added to the burden of existing teachers.

Table 18: Workload reported by Principals and Teachers

S. No	School type/size/sections/district	Principal-Periods per week	Teacher- Periods per week	Is workload is appropriate? (Teachers' response)
1	Government large urban (917- 16 sections)	24 to 28	24	yes
2	Government small urban(73- 3 sections)	16 to 18	18	No- less than appropriate
3	Aided large urban(720- 11 sections)	30 to 35	28	Yes
4	Aided small urban(35- 3 sections)	18 to 20	18	Yes
5	Government large rural(103- 3 sections)	22	15 to 18	Yes
6	Government small rural(34-3 sections)	22	17	Yes
7	Aided large rural(273-6 sections)	20 to 30	36	No- Workload is excessive.
8	Aided small rural(99-3 sections)	No response	18 to 20	Yes
9	Government large tribal(266-9 sections)	20 to 26	24 to 30	No- Workload is excessive
10	Government small tribal(32-3 sections)	23	15	Yes
11	Aided large tribal(455- 9 sections)	25 to 28	24	No- Workload is excessive
12	Aided small tribal(112- 3 sections)	20 to 30	18	Yes

Source: Qualitative Data, 2015

There were mixed reactions regarding workload from teachers. While eight teachers felt their workload was appropriate, four didn't agree and felt their workload was not appropriate. While two teachers in government schools who reported only taking 15-18 classes and another two aided school teachers who were taking 18-20 classes per week felt their workload was appropriate, only one government teacher in an urban small school felt that her workload was less than desired since she was taking 18 classes per week. Teachers stated that the workload became too much because they were involved in Continuous Comprehensive Evaluation(CCE), record keeping along with regular teaching, when they got involved in projects and when there were fewer teachers in the school. A teacher (aided large rural) shared that there were fewer facilities in the rural areas which made it difficult to complete additional tasks assigned to them including life skills and library periods. Also an increased workload related to taking extra subject teaching became a major problem in improving the quality of learning amongst high school students, whose basics were not good at primary classes and the teachers needed to do extra work to cover up existing gaps.

4.4 Teacher Management Processes

The above mentioned analysis of demand of subject teachers has immense bearing on teacher rationalisation and recruitment, because it seems clear that there exist a large number of subject teachers in the state, but they are distributed across a large number of secondary schools (majority of which are very small), spread across the state. Comprehensive planning to ensure that at least the government and private aided schools have 5 subject teachers for secondary classes, seems to be absent. Given the above mentioned situation, we look at issues related to provisioning of teachers, since these may well be related to teacher shortages.

4.4.1 Recruitment and Appointment Process

The recruitment process, which was earlier handled by the Employment exchange, is now administered by the Central Admission Cell (CAC) in Karnataka. The CAC is attached to the Commissioner of Public Instruction's office and is responsible for the recruitment of all civil servants, including teachers in the state. There are two types of recruitments direct and indirect. The process of direct recruitment is described below. Indirect recruitments are teachers recruited/appointed due to a promotion, substitution (for example pregnancy or illness) and on compassionate grounds. For direct recruitment, once the vacancies are identified, the recruitment process has to be through a Government order, with clearance from the finance department and based on the directions given by the Director of Public Instruction.

Karnataka, based on the stipulations of NCTE, has adapted the Common Entrance Test (CET) to accommodate the GOI Teacher Eligibility Test. Since 2013 the test is renamed Karnataka Teacher Eligibility Test. The test is a multiple choice test with 150 questions. Only about 10 percent of students passed the test in 2013. Candidates are shortlisted based on performance in these tests and the age of the applicant. The minimum age for applying to the teaching profession is 21 years and the maximum age is 40 years for general category. Earlier relaxations of educational qualifications for applicants from disadvantaged communities does not apply any more (CBPS, 2014). However, minimum marks required to clear the CET for reserved categories is lower. In addition, the age limit for applying to the teaching profession is also higher - 43 years for Other Backward Class (OBC) category and 45 years for SC/ST categories. Candidates make their choices for school appointment based on the vacancy list and roster. Through a process of "counselling," the CAC matches the candidate choices with what is available. The selection authority is the Joint Director of Public Instruction at the Division level. The appointing authority is the Deputy Director for Public Instruction at the district level who appoints and posts teachers to existing vacancies in the district (RMSA-TCA, 2015)

Recruitment process as defined by qualitative interviews covering government and aided schools reveals that teachers were appointed either through common entrance test and state level recruitment process including counselling or promoted from elementary schools. In the sample schools three government teachers were directly appointed by the government through CET and state level recruitment, while another three were promoted to high school from elementary school. In aided schools the teachers were directly appointed by the management and approved by the government and one teacher was appointed for a back log post for STs. All three district officials shared that to address reservation quotas a roster system was followed in

recruiting the teachers based on their social category. One of the officials expressed that there were some social problems related to recruitment of certain caste groups, since teachers were not willing to work in schools where majority of teachers did not belong to his/her social category.

One of the major challenges mentioned by state officials was the delay in recruitment due to court orders. State officials reported spending a copious amount of time in dealing with various court cases and the declaration of the recent Karnataka Teacher Eligibility Test results for secondary schools had once again been postponed due to a judicial order. Forum of Karnataka Retired Education Officers (F-KARE) (2012) pointed out that the gap between occurrence of vacancy and filling up of the post is more than several years seriously affecting the quality and academic work of the schools.

4.4.2 Ineffective Deployment

Teacher deployment and transfer are key components of an effective teacher management system. In secondary education, it is critical that schools have an adequate number of teachers in core subjects, which is dependent not only on the recruitment process described above but also on how teachers are deployed across the state. Four government school teachers stated that the process of deployment is done by deputing teachers to a school where there is a shortage of teachers. The major challenge faced in deployment was that teachers were not willing to work in remote and interior areas and places where there was a lack of vehicle facilities. Three teachers from aided schools stated that, there was no process of deployment within their schools. This is clearly a challenge in addressing teacher demand and supply.

An analysis of regular teachers in zero enrolment schools also portrays the skewed distribution of teachers in the state. While Karnataka has a large shortfall in subject teacher availability as shown by both the quantitative and qualitative data, 38 schools with 147 teachers have zero enrolment. Majority of these schools are located in Bangalore South and North and all of them are private unaided schools. While we cannot attribute the reason for this, it is apparent that effective deployment of teachers could lead to addressing the current shortage of subject teachers and needs to be taken up seriously.

Table 19: Number of Schools with teachers and zero enrolment

District Name	No. of Schools	Regular Teachers	Contract Teachers
BANGALORE U NORTH	11	34	2
BANGALORE U SOUTH	16	65	
CHIKKABALLAPURA	1	1	
DAKSHINA KANNADA	1	3	
GULBARGA	2	3	5
KODAGU	1	3	
KOPPAL	1		29
MANDYA	2	3	5
RAICHUR	3	11	3
Grand Total	38	123	44

Source: Karnataka State Data

4.4.3 Sanctioning of Posts

According to the Karnataka State Education Report 2013-14, 117,941 positions have been sanctioned in secondary education, of which 106,689 were filled and 11,252 remain vacant (Table 20). The Department of Education shared that in 2014-15, it had sanctioned 40,043 posts for teachers for secondary classes, out of which 35,111 have been filled and 4,932 posts remained vacant (12 percent). Therefore it is apparent that given the subject teacher vacancies in the state and less than 5 percent schools with 5 subject teachers, sanctioning of posts itself is a major challenge. The large number of small secondary schools in Karnataka makes this task of providing core subject teachers even more challenging.

Table 20: Teachers vacancy status

Management Type	Sanctioned	Working	Vacant	percent vacant
Government (DPI)	43553	39110	4558	10
Tribal/Social Welfare Department	2854	2392	462	16
Local body	476	300	176	37
Aided	33660	29030	4630	14
Private	36601	35233	1368	4
Central Government	755	724	31	4
Total	117,941	106,689	11,252	

Source: Karnataka State Education Report 2013-14

The JRM 2014 noted that sanctioned positions in 15 percent of government and 12.5 percent of aided schools remains vacant. There have been reports pointing to the long lapses in filling up vacant posts in government secondary schools and also, when a vacancy occurs during the academic year (due to additional sanction, promotion, retirement, death, transfer, etc.) the vacancy remains unfilled during the year (F-KARE, 2012).

As mentioned earlier, principals had specifically mentioned the absence of sanctioned English language and mathematics teacher posts across schools. All district officers mentioned that information about timely vacancies and requirements were sent to the government, but two of them said that they did not know the reason for non-sanctioning of posts.

The state officials interviewed in Karnataka identified the main challenge in recruitment of teachers in government and private aided schools as constraints in the budget. The Department of Public Instruction was only able to undertake the process of recruitment of teachers based on the financial condition and approval of the Finance Department at the state level. New appointments were not sanctioned since it would be a drain on the state exchequer. Clearly a huge gap exists between demand and sanctioning of subject teacher posts, which requires urgent attention.

4.4.4 Guest Teachers

Appointing guest teachers was a strategy which government schools adopted to deal with subject teacher shortage. There were 1,727 guest teachers appointed for the year 2015-2016 by the Government of Karnataka for secondary schools who would be distributed in the districts. All three district officials shared that the government's strategy to address teacher shortages was to appoint guest teachers to fill up the vacancies arising out of retirements or transfers or

long leaves. The 32 vacancies for English teachers had been filled up by such guest teachers in the tribal district, 40 guest teachers had been appointed in the urban district and then they were distributed according to the need of the schools in the district. The salary of guest teachers was fixed at Rs. 6000 per month. The official from the rural district did not share if the vacancies had been filled up.

The guest teachers are recruited by the government every year annually (not throughout the year) in the beginning of academic year based on the requirement of the teachers in the schools. No separate exams are conducted for the recruitment of guest teachers. As stated earlier the vacancies and requirement list is collected from each school in the district and forwarded to the state. The candidates who fulfil the criteria (M.Sc., B.Ed. or B.Sc. B.Ed.) for secondary school teachers can apply for the posts and teachers are appointed based on merit by the School Development Management Committee. However a teacher (Government small urban) shared that the salary paid to guest teachers was low and effective teachers were not being appointed. The guest teachers stay in their posts till there is direct recruitment from the government.

However, in aided schools there was no provision for guest teachers or deputation. This appeared to one of the major issues being faced by aided schools. A district official stated that in aided schools the management usually addressed shortages by making arrangements for temporary teachers. Aided school teachers also stated that vacancies are filled up by appointing temporary teachers by the management and that filling up the vacancies was a challenging task since the government did not provide deputation options, the management did not have the power to appoint guest teachers and it was difficult to find teachers in the rural areas.

4.4.5 Emerging Concerns & Recommendations Regarding Teacher Demand in Karnataka

1. Ineffective Teacher Distribution

In light of the fact that only a small percent of schools in Karnataka have five subject teachers and subject teachers are spread out amongst both small and large schools without any planning, we need to accept that provisioning of sufficient teachers in the five core subjects requires urgent attention.

2. Data Issues and Mismatch between Specialisation and Subjects Taught by Teachers

There is a need to unpack the specialisation subjects of all teachers, which can only be determined if teacher subject specialization/methods papers taken up in B.Ed. is made available for all secondary teachers. Unless a teacher Management Information System (MIS) is developed that provides such vital information, mismatch between subject specialisation and subjects that teachers are assigned to teach becomes exceedingly difficult to ascertain. This is further complicated by the existing data on appointments which shows a very large proportion of teachers in secondary education appointed for 'all subjects'. It is important that data regarding teachers who have been promoted needs to be updated in their professional qualification and their correct appointment to be reflected, so that this can support better demand forecast in the state.

3. Sustaining and Strengthening Teacher Rationalization Efforts

There are two aspects associated with teacher rationalization. First, districts in Karnataka have, on the one hand, schools with teachers and no students and on the other hand, a significant number of schools are without requisite subject teachers. The state has begun the challenging task of teacher rationalization. Monitoring the implementation of the actions described in the different government circulars will be critical to avoid delays in expediting teacher rationalization in Karnataka. The state may wish to consider a variety of solutions to this issue such as a golden handshake or providing different options such as transferring teachers to districts that have a severe shortage of teachers.

4. Building Efficiency in Secondary Schooling

Approximately 61 percent of secondary schools in Karnataka (Grades VIII-X) have less than 160 student enrolled. This fact raises issues related to whether it is financially feasible and administratively efficient to appoint core subject specialists irrespective of student enrolment given the distribution of schools in Karnataka. The large scale shortage of subject teachers in core subjects, is also to a large extent attributed to lack of sanctioned posts, which in turn is linked to existing budget constraints. The policy option of clustering small schools or connecting small schools with a larger school with shared core subject specialist teachers could be explored. This way secondary schools will be able to get the requisite number of teachers without undue wastage of human resources.

5. Meeting Teacher Demand is Key to Ensuring Quality

Though this study did not have a focus on quality of secondary education, it is obvious based on the qualitative analysis that subject teacher shortage is impacting quality of secondary education adversely. As a result of teacher shortage teachers not trained in certain content areas are substituting teachers who are not available. Clearly RMSA goals of access and equity require that quality of teaching must be assured across all schools, particularly those serving disadvantaged populations.

4.5 Supply of Teachers in Karnataka

Since the study has adopted a behavioural analytical model which examines alignment of demand as well as supply of teachers, it examines the number of new teachers being produced in Karnataka in the past three years.

Karnataka has a total of 328 teacher colleges affiliated to eleven universities located in 11 districts of the state. The current study captured supply data from 276 colleges, the majority of which were private unaided colleges (263). The supply data was not captured from 52 colleges, therefore the analysis is based on supply side data from 85 percent of teacher colleges in the state of Karnataka. Gulbarga University has the maximum number of affiliated colleges and sanctioned seats with 55 affiliated colleges, followed by Bangalore University and Mysore University, whereas Tumkur University has only 5 affiliated colleges (Table 21).

Table 21: University, District & Year wise Maximum Number of Seats Approved for Admission

Name of the University	# Colleges	District Name	2011-2012	2012-2013	2013-2014	Total
Bangalore University / Christ University	50 / 1	Bangalore	15.9	15.6	16.4	16.0
Davangere University	26	Davangere	10.1	10.1	9.9	10.0
Gulbarga University	55	Gulbarga	20.7	21.0	20.9	20.8
Karnatak University	29	Dhardwad	10.5	11.0	11.0	10.8
Karnataka State Women's University	10	Bijapur	3.7	3.9	3.8	3.8
Kuvempu University	15	Shimoga	5.5	5.8	5.6	5.7
Mangalore University	18	Dakshina Kannada	6.6	5.2	6.4	6.1
Rani Channamma University	18	Belgaum	6.8	6.9	6.8	6.8
Tumkur University	5	Tumkur	1.9	1.5	1.1	1.5
University of Mysore	37	Mysore	14.2	14.3	13.9	14.1
Vijayanagara Sri Krishnadevaraya University	12	Bellary	4.1	4.7	4.2	4.3
Total	276		100.0	100.0	100.0	100.0

Source: Karnataka Supply Study

A gradual increase in the number of seats is visible over the past three years (Table 22). The TMD study (RMSA—TCA, 2015) noted that though the number of seats available were high, the number students actually admitted was about half this number. State officials shared that a large number of unaided colleges had closed down between the academic years 2012-13 and 2013-14 (RMSA-TCA, 2015). The current study based on supply data collected from Universities found that the total number of approved seats had not been filled, though there was progress in filling seats over time. In 2011-12, 10.7 percent of seats remained vacant, whereas in 2013-14 vacant seats had reduced to 2.9 percent.

Table 22: Seats Approved and Filled in B.Ed. Colleges of Karnataka

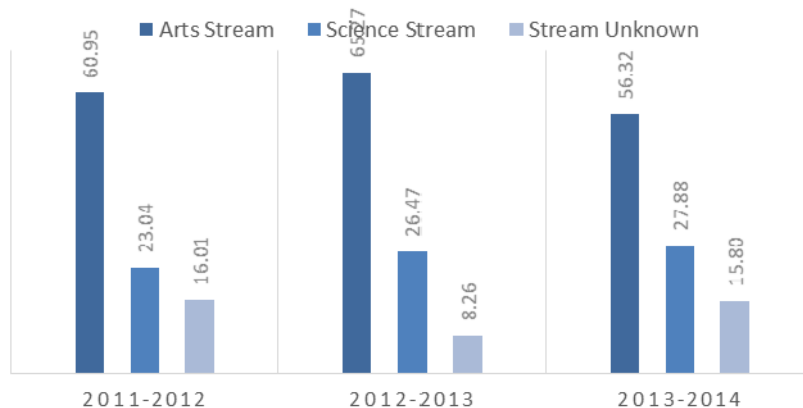
Year	Total Seats Approved for Admission	Total Candidates Admitted	Number of vacant seats
2011-2012	25513	22761	2752
2012-2013	25606	22413	3193
2013-2014	26302	25520	782

Source: TMD Review

4.5.1 Seats Filled in Colleges of Teacher Education by Streams

Since secondary school teachers specialise in certain subjects during their B.Ed., the supply side data captured information about student's choice of stream i.e. Arts or Humanities or Science. The analysis of admitted students reveals that the maximum number of seats were filled in the arts stream over the past three years, though there appeared to be a slight increase in the number of students opting for the science stream, even taking into account the limitations of data which does not inform about choice of stream of a large number of students (Fig 13).

Figure 13: Percent of B.Ed. Students stream

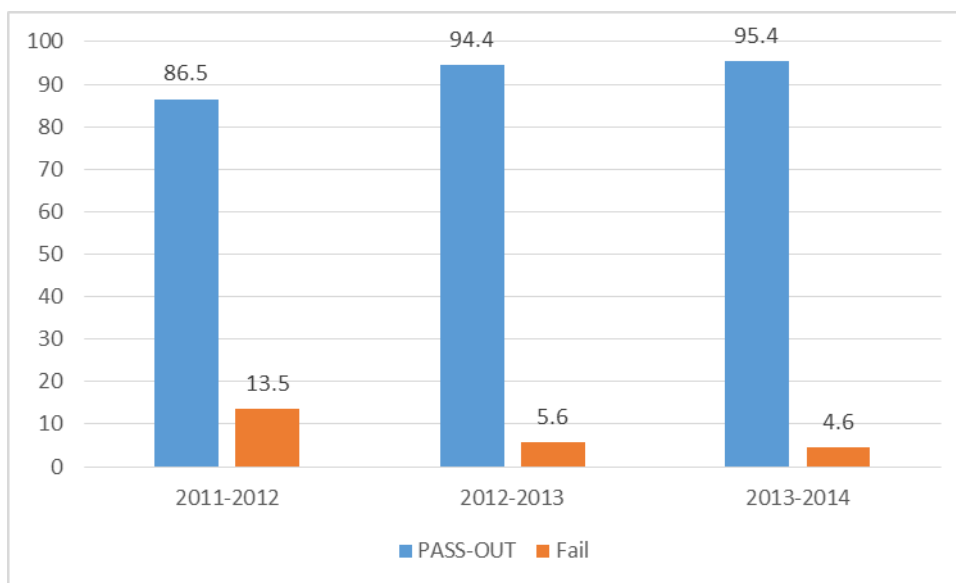


Source: Primary Data from Colleges in Karnataka

4.5.2 Teacher Success Rate

The pass percent of teacher trainees remains high and analysis of the data highlights improvement in success rate over the past three years, with almost a 10 percent improvement between the years 2011-12 to 2013-14 and 95 percent of candidates passing B.Ed. successfully in 2013-14. (Fig 14)

Figure 14: Pass Percent of B.Ed. Students



Source: Supply data from Universities

4.5.2.1 Pass Percent of B.Ed. Students by Gender & Social Groups

An analysis of the data of passed out B.Ed. students by gender and social categories reveals that approximately 60 percent of teachers qualifying to become teachers are women and the largest share of teachers being trained belong to Backward classes (approximately 57 percent), followed by general category (20 percent) and Scheduled Castes(17 percent) in Karnataka. Only 5 percent of the qualified teachers are STs. This evidence is important since it has important bearing on the recruitment process in the state, given the reservation policy for disadvantaged groups.

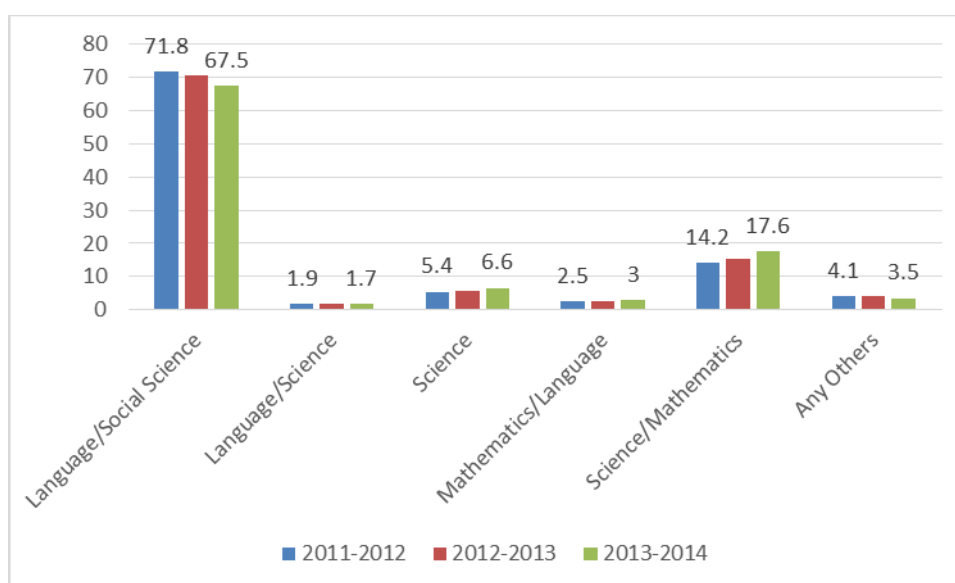
Table 23: Passed out Students (percent) by Gender and Social Groups

percent Total Passed Students by Gender & Social Groups						
Year	Male	Female	SC	ST	OBC	Gen
2011-2012	40.2	59.8	18	5	54	23
2012-2013	37.2	62.8	17	5	57	21
2013-2014	36.9	63.1	17	5	60	18

Source: Supply data from Universities

4.5.3 Pass Percent of B.Ed. Students by Subject Specialization

Given that B.Ed. candidates choose two methods or specialization papers, the supply data capture forms provided information about subject specialization besides streams that the students pursuing B.Ed. had undertaken (Fig 15). While close to two-thirds of candidates took up Language with Social Sciences in 2013-14, 18 percent of the teacher trainees took up Science and Mathematics and another 7 percent took up other Science combinations. Language with a combination of Social Sciences remained the most popular subject specialization during last three years. However, we do notice that a decrease of 4.3 percent points in students taking up Language and Social Science between the year 2011 to 2014 and students taking up Science and Mathematics (increase by 3.4 percent) and Science (increase by 1.2 percent) seem to be gaining popularity. A limitation of the data was that the specific language subject that teachers had chosen (e.g. Kannada or English) was not captured.

Figure 15: Combination of Subject Specialization in B.Ed. (2011-12 to 2013-14)

Source: Quantitative Supply Data collected from Universities

4.5.4 Job Preferences After Completing B.Ed.

It is clear from the above analysis that close to 25000 teachers passed B.Ed. successfully in 2013-14 and a total of 65214 students successfully completing their B.Ed. during the period 2011-12 to 2013-14. Given this trend of teacher supply from teacher colleges in Karnataka, it is critical to examine how many of these candidates would enter the teaching profession and join secondary schools to fill up the demand gaps.

The qualitative group interviews with teacher trainees in 12 teacher training institutes captured why students were pursuing B.Ed. and also their job aspirations to examine how many might seek secondary school jobs. Motivation for pursuing B.Ed. was largely attributed to students' own interest or family pressure to join the profession during the group interviews by 42 trainees out of a total of 48. A few trainees (approximately 9) who were already teachers, primarily joined B.Ed. because it was a mandatory requirement for continuing in schools. Seventeen of the forty six teacher trainees (36 percent) expressed their preference to working in a PU/degree colleges, while another twelve (26 percent) expressed interest in taking up higher studies. On the other hand a quarter of the trainees wanted to work in a private school and 19 percent in government schools after completing their B.Ed. In short only 46 percent of candidates expressed interest in joining secondary school as a profession, which has huge implication for calculating supply and demand of teachers (Table 24).

Table 24: Student's career preferences after B.Ed.

Institution type/district type	Government/Aided School	Private School	PU/Degree college	Higher studies
Private institution in rural district	1	1	3	1
Government aided institution in rural district	1	4	2	1
Private institution in urban district	1	3	2	2
Government institution in urban district	2	1	4	1
Government institution in tribal district	2	2	2	2
Private institution in tribal district	2	1	4	1
Total*	9	12	17	8

*2 respondent's responses not clear

Source: Qualitative Data, 2015

Three principals (private rural & urban, government aided rural) of teacher training institutions suggested that even amongst the candidates who expressed interest in getting secondary school jobs, majority of students showed preference for private school jobs. A minority (19.56 percent) were in favour of government jobs, and they gave job security in government schools and the higher workload in private schools as key reasons for preferring government schools. Private schools were preferred by the majority because they offered a scope for creativity; good salaries; good infrastructure and candidates could join a private school immediately after completing their B.Ed., instead of waiting for a long time to get jobs in government schools. They also preferred private schools as it was difficult to get a government job. One of the principals shared that as there had been no recruitment in some districts for past three to six and years, most students would join private school even though they may prefer government school jobs. Another principal ratified this by drawing attention to the fact that in light of decrease in the strength of students in government schools, many schools were being closed and the teachers in such schools were being redeployed and no recruitment had occurred in the district during the past six years. Due to this non recruitment fresh student teachers were being absorbed only in private institutions.

This trend had also been noted in the TMD review. It stated that demographic decreases in student populations and the increase in the number of private schools influence the number of teachers which the state will require over the next few years. Pre-service training institutions are accommodating the impact of the changing demographic landscape on teachers in the state (TMD, 2015).

4.6 Challenges for Supply of Secondary Teachers

Drawing upon both quantitative and qualitative evidence, challenges in the supply of teachers in Karnataka is given below.

4.6.1 Subject Teacher Shortages despite Adequate Number of Colleges of Teacher Education

The interviews with principals of colleges of teacher training institutes pointed towards there being sufficient teacher training institutions for the students to pursue their ambitions of becoming teachers, in all the three sample districts. This was reiterated by a state official who also commented that there were more than the required number of CTEs in Karnataka. While three principals of CTEs were of the opinion that supply of teachers in the district was enough, two (private rural and urban) pointed to a shortage of science and arts teachers in English medium, while another pointed to a shortage of science teachers only (government urban).

4.6.2 Absence of Reservation of B.Ed. Seats by Stream leading to Excess of Arts Teachers

While the principals of private aided and unaided CTEs informed that there were no reservations by stream, trainees in government teacher training institutes informed the qualitative interviewers that 50 percent seats were reserved for both Arts and Science candidates. This however, was not confirmed by the state officials who informed the researchers that the allocation of seats by subject remained ad hoc and was monitored by affiliating Universities, not by NCTE who only prescribed total number of seats per college.

An analysis of subject choices in the twelve teacher training institutes chosen for the qualitative research revealed a significant imbalance amongst students with Arts and Science specialisation (Table 25). Teacher trainees from the government aided institution (rural) shared that there was a balance in the number of science and arts student teachers for the current year but there was an imbalance seen in many other colleges in the district and also there had been an imbalance in the previous year's enrolment. CTE principals agreed that this trend would affect the supply of science teachers in their districts, and also predicted a short supply of Humanities teachers in the English medium in urban and rural districts.

Table 25: Student Distribution by Subject Streams (percent)

Institution type/district	Subject specialisations chosen by Students (percent)	
	Arts	Science
Private aided and unaided teacher training institution in rural district	70	30
Private institution in tribal district	72	28

Private institution in urban district	75	25
Government aided institution in rural	50	50
Government institution in tribal district	50	50
Government institution in urban district	50	50

Source: Qualitative Data, 2015

All principals commented that the number of students in B.Ed. choosing the science stream was falling especially in chemistry and biology. Majority of the students in rural, tribal and urban settings chose arts. According to them approximately 55 percent candidates chose Arts and 45 percent chose Science in rural teacher education institutes, while 60 percent students chose Arts and 40 percent chose Science in urban colleges of teacher education. This seems aligned to the quantitative data (Fig 15) collected from the Universities and colleges.

Examining reasons for this, three principals and a large number of students interviewed speculated that the reason for this may be that majority of male students with Science graduation prefer joining an industry or take up engineering or office work. Teacher trainees also felt that the imbalance across streams was a result of the numerous other options available to science students like engineering and medical. Science students after pursuing a master degree would join companies instead of doing B.Ed. One principal opined that there are very few students taking up basic science courses at undergraduate level and that was affecting the number of Science students getting admitted to B. Ed colleges. Some teacher trainees also felt that pursuing arts was easier than science at the undergraduate level, thus most of them chose to study arts and then take up B.Ed.

Teacher trainees during the group interview expressed that the teaching profession was not considered attractive enough by science graduates who had other attractive options. All these factors undoubtedly led to less students taking up Science and mathematics in particular. While language was taken up by the largest number of students as shown in the quantitative analysis, the data does not reveal whether students opted for English as their specialisation, since this information was not available.

4.6.3 Gender & Caste Disparities

There was a clear gender imbalance in enrolment as the majority of the student population in the nine teacher education institutions in the three sample districts comprised of females and in one institution 75 percent of the students were females. Some principals speculated that the reasons for above was that while male students joined factories, engineering or office jobs, women preferred teaching jobs, going for higher studies and joining PU colleges.

A government college principal shared that SC and ST students mainly took up Arts stream and that 60 percent students opted for arts and 40 percent students opted for science in B.Ed. The principal was of the view that this may lead to a shortage of science teachers in the district if the trend continued.

4.6.4 TET an additional hurdle in joining Government Schools

Clearing the CCE exam has been made a criterion for applying for secondary school jobs in government and private aided schools. In 2015 a CCE exam was held in Karnataka. Though the results for the same had yet to be declared due to a court order, the number of applicants provide a good idea of the number of teachers who were keen to take up a job in government secondary schools. A total of 264456 candidates sat for the teacher test. Of these, 45 percent of the applicants were for Arts subjects, 11 percent for Physics/ Maths/ Chemistry (PCM) students and 21 percent teachers to teach Kannada language. English teachers were only 8.5 percent of the applicants, while 5 percent teachers could teach Hindi.

Table 26: Number of Candidates in CCE held in 2015

SUBJECT NAME	TOTAL NO. OF CANDIDATES APPLIED	Percent
Arts	119966	45.4
Physical Education Grade 1	12422	4.7
CBZ	9528	3.6
PCM	29127	11.0
Language Kannada	55186	20.9
Language English	22483	8.5
Language Hindi	13271	5.0
Language Urdu	1977	0.7
Language Marathi	318	0.1
Language Sanskrit	155	0.1
Language Tamil	23	0.0

Source: DPI Karnataka

The estimates of the percent of students who had cleared the CCE exam captured by the qualitative research showed varied responses. Two college principals stated that a large number of students had appeared for the common entrance, however one principal (government tribal) and some student teachers (government tribal & urban) stated that there had been no notifications for entrance exam and so the students had not appeared for it (Table 27). Undoubtedly, since recruitment process for government and private aided schools is dependent on CCE being held and results being declared, the delay and long wait can be a deterrent and likely to push trained unemployed teachers to look for other job options.

Table 27: Number of Candidates who appeared for CCE

Institution type/district type	CCE given	CCE not given	Percent who had taken the test As reported by students	Estimates of students (percent) who appeared for CCE by CTE principals
Private institution in rural district	3	5	37.5	20
Government aided institution in rural district	3	5	37.5	30
Private institution in tribal district	8	0	100	60
Government institution in tribal district	4	4	50	-

Private institution in urban district	0	8	0	20
Government institution in urban district	8	0	100	-

Source: Qualitative Data, 2015

The importance of the CCE was evident by the principals' (private urban & rural) comments about the support being provided to students to clear the exam through extra coaching classes to help students to clear the exams. CTE principals and teacher trainees stated that the B.Ed. curriculum content on educational psychology, educational administration, school management, teaching methodology, practical teaching, and exposure to the syllabus for secondary classes was helping students to be successful in the exam. However, they also said that the curriculum had to be revised and updated in light of the changing scenario and technologies. All the principals and some teacher trainees suggested that the curriculum should include general aptitude and in depth study of foundations of the education which would help students in passing the entrance exams.

4.6.5 Ineffective Planning Process to Synchronise Supply with Demand of Subject Teachers

Interviews with district officials, as well as state officials from higher education, RMSA and NCTE revealed that there existed no coordination between departments to identify the gaps and ensure that subject teacher posts were filled with competent teachers. Officials were quick to recognise that no department had undertaken the task of collecting information related to number of students passing through B.Ed. by subject to get a true hold of supply issues. However, the openness of the Higher Education department to host the online data collection drive of this study (i.e. google form on its website) showed that the state was keen to bridge the existing gap in vital information of supply of teachers. While all stakeholders took cognisance of the need to coordinate efforts between higher education, NCTE and DPI, it was evident that no one was taking the lead to take the responsibility of planning to synchronise the demand and supply of secondary teachers. The planning process in the state to synchronise supply with demand of subject teachers appears to be a fragmentary rather than an organised process.

The officials admitted that there was a need to study the demographics and collect evidence about demand to plan for the future supply of subject teachers over the next five to ten years as there was a dwindling student population in government schools as children were opting for private schools. Another state official shared that it was important to undertake an analysis of students taking up Science and Maths at the higher secondary level and particular emphasis paid to providing incentives to students in rural and remote locations.

Suggestions from the state officials in addressing the current shortages in subject teachers included

- Use of technology
- Open schooling expansion with quality assurance
- Create one cadre of teachers who could teach grades 6-12 and have one entrance exam valid for these teachers.

4.6.6 Concerns Related to Two Year B.Ed.

The new B.Ed. introduced in 2015-16 for two years duration instead of one year raised a large number of concerns amongst stakeholders. Admissions for the current academic year 2015-16 were not over when the research team visited Karnataka, but there was overwhelming concern raised by state officials that less than 50 percent seats in teacher training institutes were likely to be filled up. This was attributed to the fact that poor students could not afford to take up a two year course and spend double the fees. Another concern that was expressed related to the fact that students were likely to consider doing their Masters instead of B.Ed. after completing their graduation since they were of the same duration. This is a matter of grave urgency, since it would directly impact the supply of teachers as also produce no teachers in the current session of 2015-16, which would be a nil year.

4.7 Projection of Teacher Demand in Karnataka

Based on the Demand and Supply Model developed for secondary school projection, we analyse the teacher paucity in core subjects across school types in Table 28. The analysis looks at availability of a minimum of two language teacher, one mathematics teacher, one social studies teacher and one Science teacher per school. The analysis does not take into account other subject teachers such as Arts, Physical Science etc. The subject teacher requirement was calculated by taking into account that 83.7 percent of the schools had only one section in Grades VIII-X, while 16.3 percent of schools had more than one section per class according to the Karnataka School data collected for 2014-15. The state norm for sanctioning additional teachers was also taken into account. The analysis also takes into consideration the number of retiring teachers i.e. replacement demand based on the analysis provided in section 4.2.1.4.

Table 28: Teacher Demand 2014-15

	Language	Maths	Social Studies	Science	Total
Government	2746	1320	3215	1674	8956
Private Aided	2300	810	2521	1452	7083
Private Unaided	5298	2355	4192	3100	14944
Others	19	5	10	7	41
Total	10362	4489	9938	6234	31023
Replacement demand	561	306	131	207	1205
Grand total	10923	4795	10069	6441	32228

Table 28 shows that Karnataka required 31023 subject teachers to fill up the existing subject teacher vacancies across school management types in 2014-15. Government and aided schools required a total of 16039 teachers while private unaided schools have a shortfall of 14944 teachers. Language teachers are obviously in greatest demand since we have taken two language teachers in the analysis. With reference to other subjects, Social Science teachers are in greatest demand and a total of 5736 Social Science teachers required for government and aided schools, whereas 4192 teachers are required in unaided schools. On including replacement demand, a total of 32228 teachers are in shortfall in 2015 across all school managements and Social Studies teachers remain most in demand and constitute 31 percent of

the total subject teacher demand, while two language teachers constitute 34 percent of the demand in 2015.

4.7.1 Projection of Teacher Demand for Next Ten Years

The projection of teacher demand of 5 core subject teachers (Table 29) reveals that the population in the age group 13-15 years is projected to decline till 2024. These figures are based on population projections made by MHRD⁵. The enrolment figures are based on trend analysis and extrapolation of secondary school enrolment during the past five years. While the total demand of subject teachers is 32228 in 2015, taking into account the number of sections across schools, the demand analysis of subject teachers in 2014-15 and the replacement demand, the teacher demand increases by a mere 474 teachers in 2024 as compared to demand in 2015. Undoubtedly, until 2018 there is a consistently rising demand for teachers across subjects, but from 2019-2024 teacher demand shows a declining trend.

Table 29: Projection for Core Subject Teacher Demand in Karnataka 2015 to 2024

Year	Population	Enrolment	Language	Maths	Social Studies	Science	Total	Replacement demand	Grand Total
2015	3224200	2757393	10362	4489	9938	6234	31023	1205	32228
2016	3179522	2812541	10570	4579	10137	6358	31644	1152	32796
2017	3133516	2820165	10598	4592	10164	6375	31730	1395	33125
2018	3088104	2810175	10561	4575	10128	6353	31617	1560	33177
2019	3042693	2799277	10520	4558	10089	6328	31495	1630	33125
2020	2997281	2787471	10475	4538	10046	6302	31362	1696	33058
2021	2951869	2774757	10428	4518	10001	6273	31219	1810	33029
2022	2906457	2761134	10377	4495	9952	6242	31066	1810	32876
2023	2861045	2746604	10322	4472	9899	6209	30902	1888	32790
2024	2815634	2731165	10264	4447	9844	6174	30728	1974	32702

Given that Karnataka currently has a total of 328 teacher training colleges which have on an average 100 seats per college, and in the last three years approximately 65,000 B.Ed. teachers have passed out the training institutes of the state, there does not seem to be a supply crunch of teachers in Karnataka. Even if we extrapolate from the qualitative evidence that around 50 percent of new teachers will join the teaching profession, there is no doubt that the supply is much more than the demand. It is also clear from the analysis that subject teacher vacancies in schools are mainly due to non-sanctioning of posts, lack of effective deployment and recruitment process delays, rather than shortage in teacher supply. Given that more than 60 percent of newly trained teachers in the past three years have been Social Studies and language teachers, clearly there is no shortage of meeting specific subject teacher demand in the state and there is urgency to coordinate demand and supply and analyse admission of students based on subject teacher vacancies in the state.

⁵ http://mhrd.gov.in/statist?field_statistics_category_tid=163

Streamlining demand and supply by long and short term planning will support the state to effectively manage its supply of subject teachers and also assure newly trained teachers with job opportunities. Quota of seats in colleges by stream and encouraging students to take up those subjects in which there is demand at both higher secondary and graduation level by providing incentives, particularly to rural and disadvantaged groups, may be a necessary step.

5. Analysis of Teacher Supply and Demand in Madhya Pradesh

5.1 Context: Madhya Pradesh

Madhya Pradesh is the second largest state in India with 51 districts organized into 10 divisions. With a population of 7.3 crores (52 percent male and 48 percent female), it is the sixth largest populous state in the country. Predominantly rural, the tribal population in Madhya Pradesh constitutes 20.3 percent and SCs constitute 15.2 percent of the state population. Madhya Pradesh has the largest tribal population in a state in the country and out of the total 51 districts in the state, 20 districts are predominantly populated by tribal communities. The total literacy rate in Madhya Pradesh is 70.6 percent (Census 2011) with male and female literacy rates being 80.5 percent and 60 percent, respectively. The difference between male and female literacy represents a disparity of about 20 percent points.

5.1.1 Secondary Education in Madhya Pradesh

Secondary Education in the state is divided into two levels – secondary also called high school (Class 9 and 10) and higher secondary (Class 11 and 12). Two departments are responsible for secondary education. The Tribal Welfare Department manages education in 20 districts and the School Education Department the remaining 31 districts. Under the leadership of the Chief Minister, the Secretary Education and the Commissioner, the Directorate of Public Instruction handles all administrative functions for secondary education. The District Education Officer at the district level and the Block Education Officer at the block level manage and coordinate secondary schooling.

Madhya Pradesh has adopted the RMSA targets for secondary education, which is to achieve a GER of 75 percent by 2012, 100 percent by 2017 and universalisation of secondary education by 2020. Currently the NER at secondary level stands at 42.9 (UDISE, 2015).

5.2 Madhya Pradesh Teacher Demand & Supply

To make an assessment of teacher supply and demand, it is necessary to understand the shortage or excess of teachers by subject at the secondary level. For the demand side analysis we have utilised the state data provided by Madhya Pradesh RMSA based on the demand side quantitative tool developed for the study and also UDISE 2014-15. The supply side analysis is based on the primary quantitative data collected from Universities and affiliated colleges running B.Ed. courses in the state. The qualitative primary data collected from schools, teacher training institutes and key stakeholder interviews provides deeper analysis to strengthen the quantitative analysis.

5.2.1 Demand of Secondary Teachers in MP

5.2.1.1 School Enrolment Status

There were 14490⁶ secondary schools in Madhya Pradesh in 2014-15 with a student of population 2569561, is enrolled in Grade IX and X. The GER has fallen to 80.2 percent in 2014-15 as compared to 83.4 in 2013-14 (NUEPA, 2015). Approximately 64 percent children were enrolled in government schools which constituted 52 percent of the secondary schools. Private unaided schools constitutes 46 percent of the total schools but cater to only 34 percent of the students enrolled which is almost half of the student population enrolled in government schools (Table 30).

Table 30: Number of Schools by Management in MP

Management type of Schools	Schools	percent Share	Enrolment	percent Share
Government	7577	52.3	1645937	64.1
Private Aided	292	2.0	50761	2.0
Private Un-Aided	6616	45.7	872462	34.0
Others	5	0.0	401	0.0
Total	14490	100	2569561	100

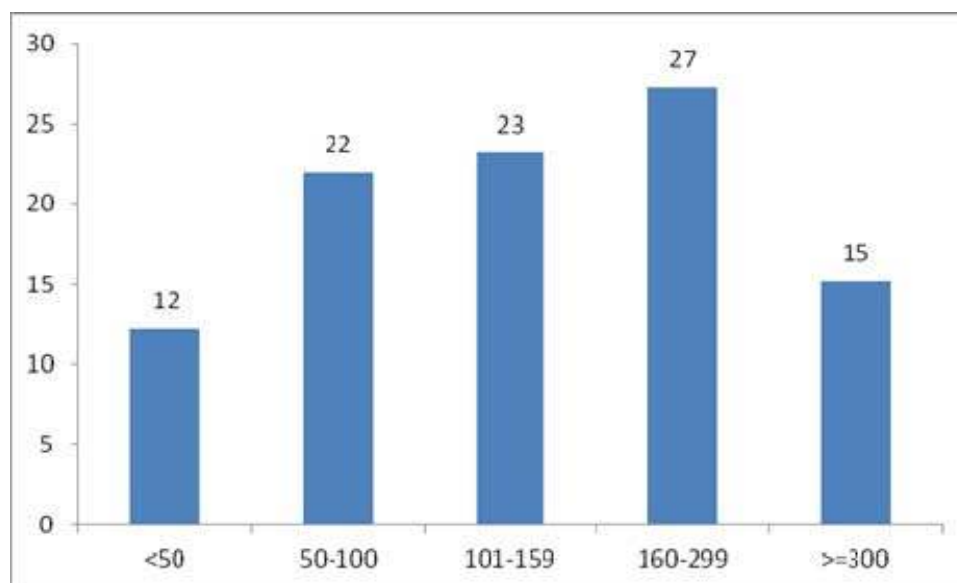
Source: MP State Data

According to the RMSA norm for a secondary school, there should be a minimum of five teachers – first language, second language, mathematics, science, and social studies in each school. In addition to the principal, each school should also have one laboratory attendant for science practical work (Government of Madhya Pradesh (GOMP), 2014). The document states that the “*minimum requirement for a school is to have no more than four sections. If any level has more than two sections, then such a school will require additional teachers for the core-subjects. There needs to be additional teachers when enrolment is above 160 students for a 40:1 Pupil Teacher Ratio (GOMP, 2014).*”

5.2.1.2 Secondary School by student population

To make an assessment of the demand of teachers at secondary stage it is essential to analyse schools by student population. In terms of distribution almost 34 percent of the schools had a population of less than 100 students, 50 percent of the school had an enrolment ranging from 101 to 299 students and the remaining 15 percent schools had a population of larger than 300 students. The majority (57 percent) of the schools have a student population of less than 160 students (Fig 16).

⁶ The number of schools differs from the UDISE figure of 12891 schools.

Figure 16: Secondary School Share Based on Student Population (percent) in MP

Source: MP State Data

Further analysis of schools by management reveals the majority of the schools with an enrolment of 300 and above were government schools (1628) while the majority of the smaller schools with a population of less than fifty were private unaided schools (1530) (Table 31).

Table 31: Number of Schools by Enrolment and School Categories in Madhya Pradesh

Management type	Enrolment	Number of schools
Government	Less than 50	217
	50 to 100	1154
	101 to 159	1966
	160 to 299	2612
	300 and above	1628
Private Aided	Less than 50	24
	50 to 100	86
	101 to 159	64
	160 to 299	76
	300 and above	42
Private Unaided	Less than 50	1530
	50 to 100	1951
	101 to 159	1328
	160 to 299	1270
	300 and above	537
Others	Less than 50	1
	50 to 100	3
	101 to 159	1
	160 to 299	0
	300 and above	0

Source: MP State Data

The qualitative data from schools in Madhya Pradesh regarding the demand side was only collected from 12 government aided and government schools but not private unaided schools in three districts Bhopal (urban), Chhatarpur (rural) and Jhabua district (tribal). The sample schools ranged from the smallest government school having 105 students enrolled in grades IX to X, to the

largest urban government schools with 627 students with nine sections across grades IX to X (Table 32).

Table 32: Sample Schools (Government and Government Aided) in Sample Districts of MP

District	Rural				Tribal				Urban			
Type of School	Aided (Small)	Aided (Large)	Govt. (Small)	Govt. (Large)	Aided (Small)	Aided (Large)	Govt. (Small)	Govt. (Large)	Aided (Small)	Aided (Large)	Govt. (Small)	Govt. (Large)
Class 9 students	55	134	152	416	41	154	183	237	64	82	153	210
Class 10 students	65	177	72	211	64	141	63	147	57	78	47	95
Total Students	120	311	224	627	105	295	246	384	121	160	200	305
No. of sections in 9	1	2	2	6	1	3	3	5	1	2	2	3
No. of sections in 10	1	3	2	3	1	3	2	4	1	2	1	2

Source: Qualitative Data, 2015

5.2.1.3 Teachers Availability by School Types

To better understand the demand of teachers, it is important to study the availability of subject teachers in schools in different managements. MP has a total of 71601 secondary school teachers (MP state data). Approximately 65 percent of the teacher workforce is employed in government schools, where 64 percent of students are enrolled and which constitute 52.3 percent of the total schools in the state. Private unaided schools employ 33 percent of the total teachers and private aided employ 1.8 percent of the teacher workforce (other schools constitute a negligible number of teachers). Clearly government and government aided schools with 66 percent of teachers employed in the state have the greater part of the teachers at secondary level in the state⁷ (Table 33).

Table 33: Number of Teachers by Management

Management type of Schools	Teachers	percent Share
Government	46275	64.6
Private Aided	1293	1.8
Private Un-Aided	24021	33.5
Others	6	0.01
Missing	6	
Total	71601*	100

Source: MP State Data

Given that secondary schools must have a minimum of five subject teachers for 160 students in Grades IX and X according to RMSA norms, we analyse the status of subject teacher availability in the State within government, aided and unaided schools. We also add analysis of schools with three language teachers, because state officials shared that government schools needed to have teachers for Hindi, English and Sanskrit.

Table 34 reveals that the implementation of the state norms seems to be a distant reality with less than 2 percent of the total secondary schools having five subject teachers. Only 1.5 percent of

⁷ The state data has information on teachers in 12730 schools i.e. 88 percent of schools. A large number of private teacher data in private unaided schools is missing.

government (109) and 2.2 percent of the private unaided schools (113) have five subject teachers. Thus out of a total of 12730 schools where the data was available, 12503 schools don't have all five subject teachers amongst which 7113 are government schools, 5132 are private unaided schools and 257 are private aided schools.

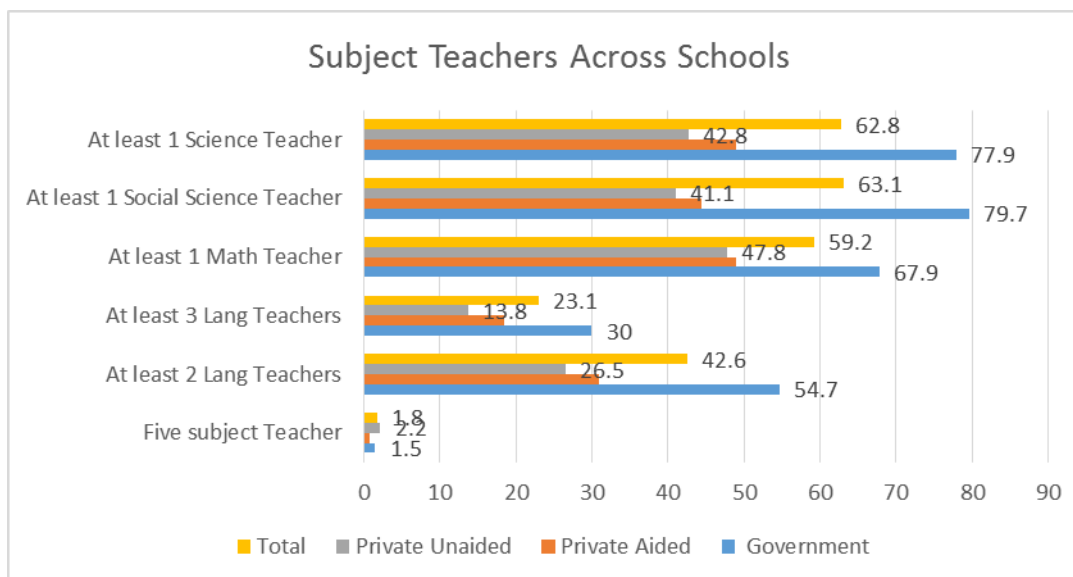
Table 34: Subject Teacher Availability by school type

	Government	Private Aided	Private Unaided	Others	All Schools	Percent of total schools
Five Subject Teacher	109	2	113	-	224	1.8
At least 2 Lang Teacher	3952	80	1392	1	7555	42.6
At least 3 Lang Teacher	2170	48	724	-	4412	23.1
At least 1 Math T Teacher	4902	127	2505	1	6857	59.2
At least 1 Social Science Teacher	5757	115	2154	1	7431	63.1
At least 1 Science Teacher	5623	127	2243	1	7257	62.8

Source: MP State Data

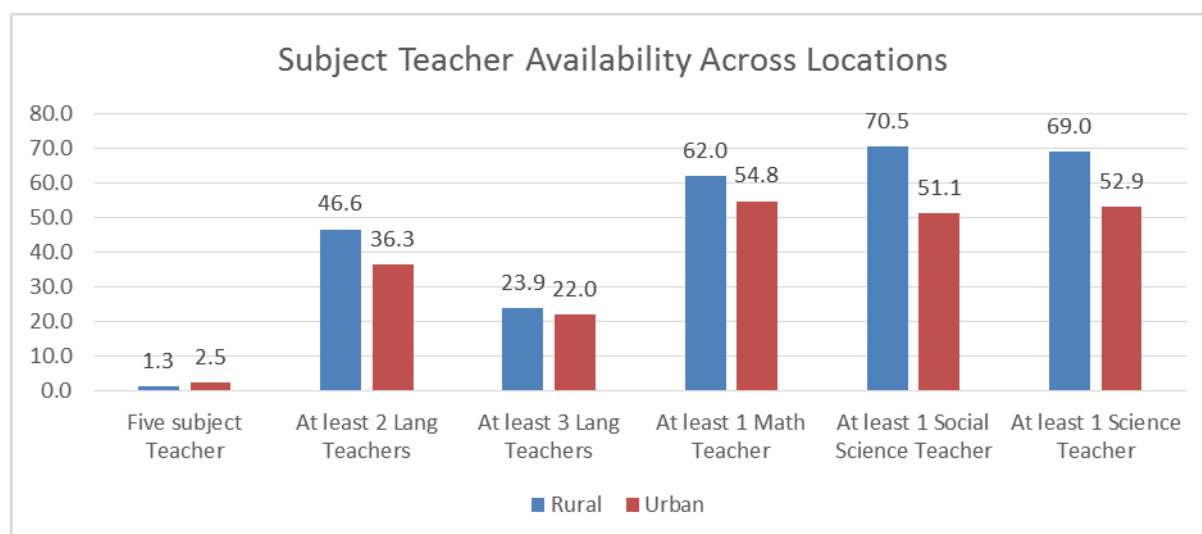
Approximately 43 percent schools have two language teachers and 23 percent have 3 language teachers across MP secondary schools. It is interesting to note that 59 percent schools have at least one mathematics teacher, 62.8 percent have at least one science teacher and 62 percent have at least one social science teacher (Fig 17). Government schools appear to have the highest number of specialist teachers across all categories of schools and private unaided have a greater shortage of subject teachers. This is very important to note and has significant policy implication for policy planning and monitoring of private schools in the state.

Figure 17: Subject Teacher Availability by school type



Source: MP State Data

Overall 61.7 percent schools are located in rural areas and the remaining 38.1 percent belong to urban areas. Both rural and urban schools suffer from the absence of availability of five subject teachers with 2.5 percent of schools in urban areas with five subject teachers, in comparison to 1.3 percent of schools located in rural areas. However subject teacher availability wise rural schools appeared to be faring better than urban schools and had more teachers in all individual subjects as compared to urban schools.

Figure 18: Subject Teacher Availability by Location

Source: MP State Data

The qualitative interviews with three district officials highlighted the reasons for teacher shortages. Shortages were due to the lack of availability of qualified candidates and applicants for teacher posts in the subjects where shortages existed. According to the officials, students who studied these subjects at the graduation level chose to pursue higher services and had no interest in becoming school teachers. The official from the tribal district was of the view that other districts had surplus teachers that they could recruit, whereas in the sample tribal district, it was difficult to recruit teachers. This was because it was considered a difficult area - geographically remote and one of the most socially backward districts. In his opinion, qualified candidates refused the option of teaching posts in remote areas, thereby leading to continued vacancies in remote areas. Lack of facilities such as residential facilities and difficult daily travel to school proved another disincentive for teachers to take up these posts. A school teacher also shared that some teachers were afraid of going to rural areas as they had to put in extra efforts to teach children in these schools, due to their background.

There also exists intra-state disparity in terms of subject teacher presence across the various districts of the state (Table 35). While Morena district has the maximum number of schools with 5 subject teachers, only 6 percent of schools in the district have 5 subject teachers, while Sidhi, Ashoknagar, Mandsaur, Neemuch, Ratlam and Sagar had no school with 5 subject teachers. Schools in Bhopal and Indore districts appear to have subject teacher shortage across various subjects.

Table 35: Districts with the highest and lowest percent of subject teachers

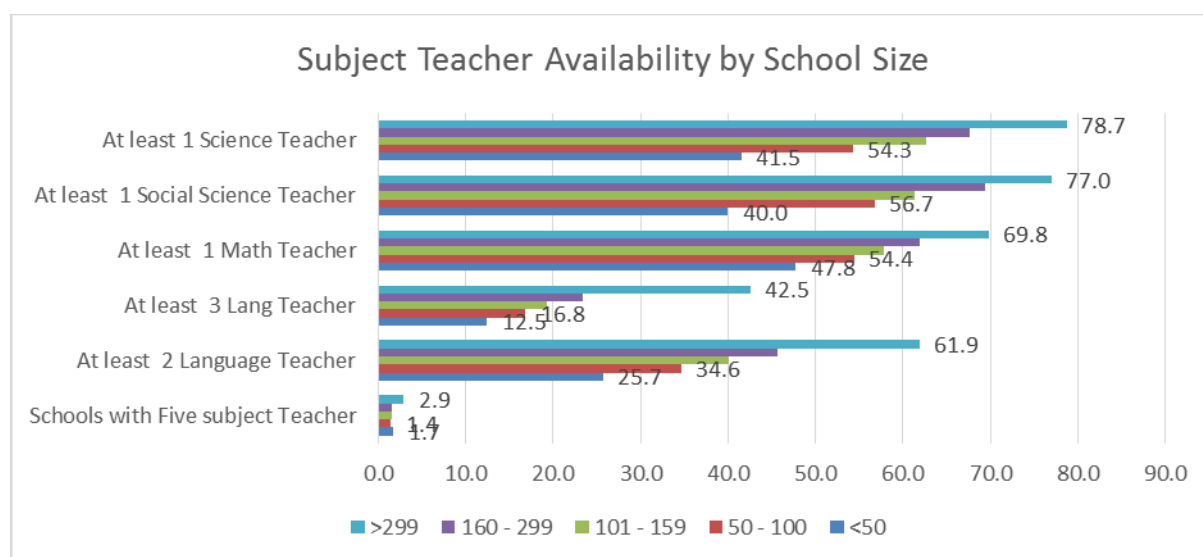
Teachers	Schools with lowest number of subject teachers		Schools with highest number of subject teachers	
	District	Percent	District	Percent
Schools with 5 subject teachers	Ashoknagar, Sidhi, Mandsaur, Neemuch, Ratlam & Sagar	0	Morena	6
Schools with 2 Language teachers	Bhopal	11	Neemuch	78
Schools with 3 Language teachers	Bhopal	7	Gwalior	52
Schools with at least one Mathematics teachers	Indore	25	Bhind	86

Schools with at least one Social Studies teachers	Indore	24	Tikamgarh	89
Schools with at least Science teachers	Indore	29	Neemuch	88

Source: MP State Data

The number of schools without five subject teachers appears to be very high across all school sizes with only 2.9 percent schools with enrolment above 299 students having 5 subject teachers as against 1.7 percent of schools with enrolment of less than 50 (Fig 19). However, there seems to be a considerable difference in terms of subject teacher availability while comparing schools of different sizes. Schools with student population of less than 50 appear to be facing the worst shortage of subject specialists while school with student's strength of more than 300 appear to be having the highest number of teachers across specific subjects. In short, one observes that with increasing school size there is a considerable increase in the number of teachers available across all subjects, except in the case of five subject teachers.

Figure 19: Subject teacher Availability by school size



Source: MP State Data

The state level data was corroborated by data from the smaller sample of schools chosen for the qualitative data collection. Shortages of teachers in maths (83 percent), English (83 percent), science (75 percent), Sanskrit (66 percent), social science (50 percent) and Hindi (33 percent) were reported in the three sample districts.

A state official stated that mostly Maths and English teachers were in short supply in MP and this was corroborated by district officials. The state official estimated that at least one-third of schools did not have Maths and English teachers. All three district officials also agreed that the demand for teachers were not being fully met in their districts and there was a shortage of teachers in all three districts. Most school principals identified shortages for English and maths teachers. While two principals (Government large rural & Aided large rural) of the rural district stated that there were shortages of maths teachers, another principal from the same district thought mathematics teacher were available in sufficient numbers (Aided small rural). However two principals stated they were unaware of the shortages at the district level (Aided small tribal) and there appeared to be sufficient staff in the schools of urban areas in their cluster (Government small urban).

Table 36: Teacher shortages in the district

School type/size/district	Overall Shortage	English	Hindi	Sanskrit	Mathematics	Science	Social Science
Government small rural	Yes	Yes	Yes	Yes	Yes	Yes	
Government large rural	Yes	Yes	Yes	Yes	Yes	Yes	
Aided small rural	Yes	Yes			Yes	Yes	
Aided large rural	Yes	Yes			Yes	Yes	
Government large tribal	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Government small tribal	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Aided large tribal	Yes			Yes			Yes
Aided small tribal	Not known						
Government large urban	Yes	Yes		Yes	Yes	Yes	Yes
Government small urban	Yes	Yes		Yes	Yes	Yes	Yes
Aided small urban	Yes	Yes		Yes	Yes		Yes
Aided large urban	Yes	Yes			Yes	Yes	
Total shortages reported	11	10	4	8	10	9	6

Source: Qualitative Data, 2015

Impact of Shortages on Students and Teachers

Interviews with principals of government and private aided schools in the three sample districts revealed differences as well as commonalities in addressing teacher shortages in the two types of managements. In aided schools, principals shared that the government had taken a decision not to provide further funding to aided schools and was only bearing costs of sanctioned posts, till the teachers in position retired. Therefore, aided schools were appointing teachers as well as guest teachers to replace long term vacancies by appointing contract teachers against the vacant posts (Aided small rural). The School management committee appoint part time teacher for subject requirement among the local young educated people. In one school all teachers were contract teachers and their salary was also on the basis of contract (Aided large rural school). It was reported that in aided schools, whenever a vacancy arose, candidates were called from an existing pool of applications, though on many occasions the applicant may refuse because they may have already been engaged/employed (Aided large tribal school).

In government schools, guest teachers were appointed if qualified teachers were not available within existing teachers in the school or nearby cluster school (Government small tribal). Guest teachers were appointed through SMDC who sanctioned the proposal of hiring a guest teacher (Government large tribal).

A state official opined that Maths and English teachers were most in short supply in MP and that at least one-third of schools will not have Maths and English teachers. S/he felt that the reason was because *“Maths and English teaching is not good, so students also do not take up these subjects for Higher Secondary and under graduation. Maths is considered very difficult and those who take up the subject prefer to take up Engineering.”*

Shortages have a direct impact on the quality of teaching as it impacts teachers' workload, if teachers are required to teach subjects they have not been trained for. In addition, guest teachers may not be well trained. All these in turn are bound to influence students' learning.

5.2.1.4 Alignment between Teacher Appointments & Subjects Taught in Schools

It is important to analyse the subjects being taught by secondary teachers vis a vis their appointment to understand how many teachers may be teaching subjects they have not been appointed for. Analysis of appointment of teachers by subject as reported by MP state data for 2014-15 reveals that 8.3 percent of secondary teachers in the state were appointed for teaching 'all subjects' (Table 37).

Table 37: Appointments of secondary teachers by subject

Appointments	Number of Teachers	Percent
All Subjects	5916	8.3
Languages	18813	26.3
Maths & Accountancy	11061	15.4
Social Sciences	15046	21
Science	14455	20.2
Others	1802	2.5
No Response	1	0
NA/missing	4507	6.3
Total	71601	100

Source: MP State Data

Since these teachers were appointed to teach all subjects, further analysis of subjects that teachers are currently teaching finds that almost 8 percent of all secondary teachers are reported as teachers teaching 'all subjects' as their first subject (Table 38). It is apparent that there exists a complementarity between subjects for which teachers have been appointed and main/first subject that secondary school teachers are actually teaching in schools.

Table 38: First Subject Being Taught by Secondary Teachers

Subjects	Total Teachers	
	Frequency	Percent
All Subjects	5478	7.7
Languages	19382	27.1
Maths & Accountancy	11204	15.6
Social Sciences	14829	20.7
Science	14524	20.3
Others	1677	2.3
No Response/NA/missing	4507	6.3
Total	71601	100.0

Source: MP State Data

It is interesting to note that the further analysis of the 5914 teachers classified as teaching 'all subjects' are found mainly within private unaided schools i.e. 81.5 percent (Table 39). It is difficult to explain why maximum number of teachers classified as teaching 'all subjects' exists within private unaided schools since it is outside the scope of this study. It may be possible that those teachers have been promoted from primary schools and are still classified as teachers for 'all subjects'.

Table 39: Distribution of Teachers Teaching 'All Subjects'

Type of School	Frequency	Percent
Government	925	15.6
Private Aided	168	2.8
Private Unaided	4819	81.5
Others	1	0.0
Total	5914	100.0

Source: MP State Data

With regards to teachers having to teach different subjects three principals interviewed during the qualitative survey, clearly stated that there was no difference between teacher subject qualifications and the subjects which secondary teachers were currently teaching. However, four others (government principals) stated that a discrepancy existed because certain teachers were promoted to secondary schools, did not have the subject specialisation required and ended up teaching a subject other than their graduation subject. In government schools, teachers are promoted from elementary schools of the department, where the basic qualification of teacher is higher secondary (+2) with a diploma in higher education. For promotion to high school the teacher should be at least a graduate in any subject. These graduation subjects may or may not be the same as secondary school subject. For example, an elementary school teacher after his appointment as primary school teacher can do graduation in commerce but commerce is not a school teaching subject in high school. Hence the teacher has to teach one of those subjects (English, Hindi, Sanskrit, Social studies, Science or Mathematics). They have to do hard work in preparing them to teach that subject (Government large tribal). Another said normally teachers had their own choice of subjects but in absence of other teachers they can be given other subjects also on the basis of their graduation subjects (Government small tribal).

Except for one teacher, all teachers who were interviewed in the three districts said they were teaching subjects which they were trained for in B.Ed. or had studied the subject in their graduation or post-graduation. It is interesting to note that none of the government teachers mentioned their appointment subject, since majority were promoted from elementary schools. For instance a government teacher shared that s/he was promoted to high school after 14 years (Government small rural). Another was promoted on a vacant English teacher post from a primary school where the teacher was employed as a Type-3 teacher. One of aided school Social studies teacher who was also teaching Sanskrit, stated there were some difficulties faced while teaching Sanskrit (Aided small urban). A Maths teacher who had not done a B.Ed. was teaching physics to Class 12 students but did not find it problematic as s/he had studied Physics in B.Sc.

5.2.1.5 Retiring Teachers

As mentioned in the analytical model, it is important to estimate demand of teachers that will emerge as a result of teachers superannuating in the future. An analysis of the current secondary teachers by age cohort reveals that the majority of current teachers i.e. 69.8 percent belong to the age range 30-40 years. Almost 20 percent teachers will retire over the next ten –thirteen years causing a large number of vacancies to occur in the next decade or so, which will clearly impact the requirement of teachers.

Table 40: Age group of teachers in MP

Age	Frequency	Percent
20s	6250	8.7
30s	24190	33.8
40s	25765	36.0
50s	12107	16.9
60s(Up to 62)	2187	3.1
Missing	1102	1.5
Total	71601	100

Source: MP State Data

Furthermore, a large share of the retiring teachers (53.4 percent) belong to rural areas. This maybe a matter of concern as finding teachers in rural areas is an issue.

Table 41: Retiring Teachers by Location in MP

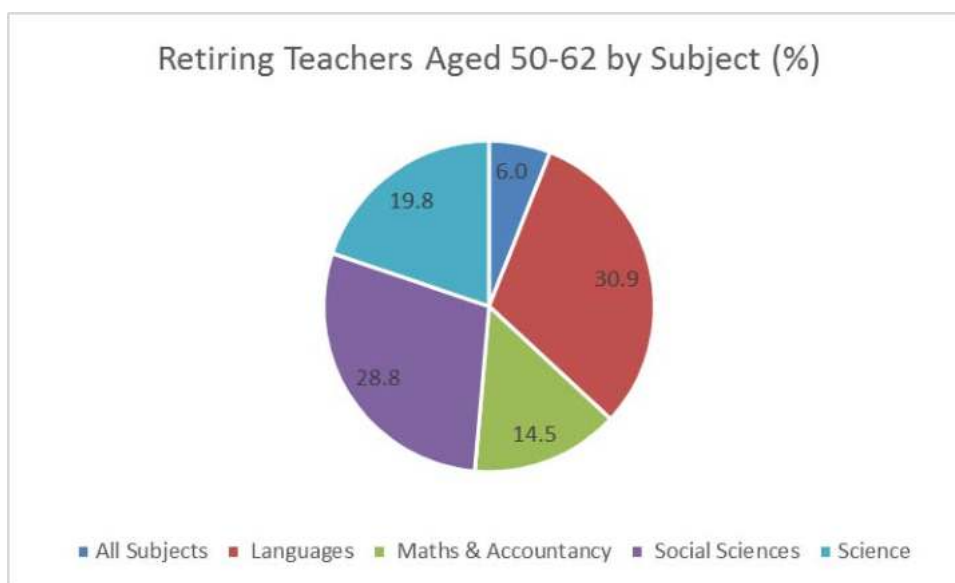
Retiring Teachers (Age)	Areas		Total
	Rural	Urban	
50	1051	768	1819
51	842	640	1482
52	878	761	1639
53	778	666	1444
54	698	576	1274
55	577	512	1089
56	500	444	944
57	438	437	875
58	387	365	752
59	399	385	784
60	338	341	679
61	423	445	868
62	322	315	637
Total	7631	6655	14286
Percent	53.4	46.4	100.0

Source: MP State Data

It is also important to analyse which subject teachers would be needed based on the subject specialisation of retiring teachers. Figure 20 shows that the majority of these will be language teachers (30.9 percent) which will comprise all three languages, followed by Social Studies teachers (28.8 percent), Science (19.8 percent) and Mathematics teachers (14.5 percent). In

short there is going to occur a replacement demand against existing sanctioned posts, majority being teachers in rural schools for the above stated subjects.

Figure 20: Subject Teachers Retiring in next 12 years



Source: MP State Data

5.3 Impact of Subject Teacher Shortage on Schools

5.3.1 Impact on Teaching Learning Process

Qualitative interviews captured the impact of teacher vacancy and lack of sufficient teachers in proportion to the numbers to students at district and school level. According to the District Education Officer (DEO), a direct impact of the unmet demand of teachers resulted in a negative effect on quality of teaching due to the absence of subject teachers. A government principal said that they managed classes in face of teacher vacancies, by trying to solve their educational problems at their own level and strived to get a good result (Government small tribal). Another principal (Government large tribal) stated that in case a particular subject teacher was not available in school, the principal would look at the qualifications of other available teachers who could teach that subject and motivated them to teach. Like this in many schools, where subject teachers were not available, current teacher/s ended up teaching two subjects. In another school there were sufficient teachers but the principal substituted for the English teacher when she was absent (Aided small tribal).

Teachers were also aware of the negative effect of substitute teachers and *shared that "children get demotivated when they don't get correct and satisfactory answers from substitute subject teachers."* Another teacher shared that *'at times children get emotionally attached to a good regular teacher and start making good progress. However, if the same teacher goes on leave for long time then children's learning gets affected. This impact was even more pronounced when teacher vacancies occur suddenly, since the curriculum cannot be completed in time and children are over burdened with covering the syllabus.'* Another teacher said that students would manage for some time without a teacher but if it continued for a year or more children who were 'good' at studies took admission in other schools. Children results were affected due to vacancies and as a teacher explained *'there was no short cut to teaching.'* Two teachers from aided schools (Aided small tribal &

Aided large urban) stated that there was no issue of vacancies impacting their school/s, since at the time of appointments, the management asked teachers to give a written commitment, that they would continue teaching for at least three years. In case of an exigency, aided school teachers reported that the principal and his assistant also took over classes and did not let children be idle or without work.

Government teachers shared that replacement of teachers who have left the profession due to retirement, maternity leave, illness, long leave or changing jobs, permission is taken by senior officers and guest teachers are appointed against vacant post to complete the syllabus. This happens if the teacher is unavailable only from the beginning of new session. Teachers reported that if the vacancy occurs in the middle of the academic session, then regular teachers are given the extra responsibility of teaching another subject and end up doing extra work by increasing their periods. One of the principal's complained that they faced shortages since teachers do not opt to teach in village schools and the payment of guest teacher was much less in comparison to the private school or the coaching centers (Government small rural).

5.3.2 Professional Qualifications

The state data also captured information on professional qualifications of secondary teachers and the analysis reveals that only about half of the teachers had a B.Ed. or its equivalent (52.6 percent B.Ed and 1.9 percent M.Ed), 21 percent had a two year teaching diploma and another 16.6 percent teachers did not have any professional qualifications. Since only B.Ed. and higher degrees such as M.Ed. are necessary qualifications for teaching in secondary schools, it would appear that many secondary teachers still need to get the requisite professional qualifications required for teaching secondary classes.

Table 42: Professional Qualifications of Secondary Teachers in MP

Professional Qualifications	Frequency	Percent
Diploma or Certificate in basic teachers training of a duration not less than two years	15055	21.0
Bachelor of Elementary Education (B.El.Ed.)	2411	3.4
B.Ed. or equivalent	37673	52.6
M.Ed. or Equivalent	1345	1.9
Others	2213	3.1
None	11873	16.6
Diploma or Degree in Special Education	1028	1.4
Not available	3	0.0
Total	71601	100.0

Source: MP State Data

5.3.3 Differences Related to Trained and Untrained Teachers

Most of the government school teachers had been deputed for pursuing their B.Ed. in the last few years on the basis of their seniority through the government CTEs as well as through the Open Distance Learning Universities like Bhoj Open University or Indira Gandhi National Open University (IGNOU). One of the principal stated that the government also gives preference to trained teacher in appointments and the school also gives preference to trained teachers in appointment of guest teachers (Government large rural).

While three principals were of the opinion that there was no difference between trained and untrained teachers, four Principals felt that a difference existed and argued that teaching quality was impacted when teachers taught subjects they had not been trained and expressed that trained teachers were definitely better. In their view trained teachers had skills and techniques for teaching and produced good results (Aided large tribal&rural). A tribal school principal felt that trained teachers completed the course in time and would do revision in the month of February. This was reiterated by another principal (Government large urban) who was of the view that trained teacher achieved the specific objectives in the class and were able to enhance the achievement level and learning capacity of children. The principal also felt strongly that untrained teachers are not familiar with evaluations and other important aspects of education. The same principal was also of the opinion that when teachers were promoted or transferred from elementary to high school on the basis of their qualification, they may face difficulty in teaching their own graduation subject, since they may have lost command on subject knowledge while working in primary classes for a long time. (Table 43).

Table 43: Difference between Subject Specialist and non- specialist subject teachers in MP

S.No	School type/size/district	Difference between Subject Specialist and non- specialist subject teachers
1	Government small rural	No
2	Government large rural	not clear
3	Aided small rural	No
4	Aided large rural	not clear
5	Government large tribal	Yes
6	Government small tribal	Yes
7	Aided large tribal	Yes
8	Aided small tribal	No
9	Government large urban	not clear
10	Government small urban	not clear
11	Aided small urban	yes sometimes
12	Aided large urban	not clear

Source: Qualitative data, 2015

Five principals on the other hand, were not sure about comparisons between trained and untrained teachers and expressed that quality of trained teachers was good and satisfactory but this depended mainly on the individual teacher's motivation. Regarding teachers who were substituting subjects they were not specialised to teach, an aided school principal shared that the fact that trained teachers taught and got better results was confirmed by students as well. However, another principal mentioned that any trained teacher with a different subject at graduation could also teach well, if they prepared themselves daily for teaching. In his or her view certain teachers who are teaching subjects without preparation and on the basis of old knowledge were not producing good annual examination results. A government school principal felt that students were the best evaluators of a teacher's work in class and they sometimes reject the teaching of certain teachers and demand other good teachers.

5.3.3.1 Quality of Guest Teachers

With regards to the quality of guest teachers a principal felt that the capability of guest teachers was not any better in comparison to the regular teachers selected by the commission (Government small rural). Another principal expressed that some guest teachers were very good, while some were not very effective, but the school had no other option (Government small urban).

An aided principal stated that the guest teachers were only appointed for the second term if they had performed satisfactorily. If they did not teach well then feedback was given (Aided large tribal), while a government school principal shared that there was a provision in the rules of removing guest teachers who were not teaching properly and calling the next candidate from the merit list (Government large rural).

Eight principals mentioned that they monitored the teaching of guest teachers by observing their teaching, teaching techniques used, examples given, communication skills, lesson planning, homework given, checking the copies of students, etc. Students feedback was taken (Aided large tribal, Aided small urban & rural). A few (Government small tribal & small urban) mentioned that they also guided them and provided them training for 10 days each (Government large tribal).

5.3.4 Teacher Workload

Given that teachers have reported teaching extra subjects other than their specialisation, teacher workload is an obvious concern. In MP we find that 99 percent of secondary school teachers are only teaching secondary classes, and only a very small number of teachers are engaged in teaching in upper primary and higher secondary schools. This is important, since the demand of teachers must also take into consideration workload of teachers by checking whether secondary teachers are also involved in teaching upper primary or senior secondary classes.

Table 44: Classes Taught by Secondary School Teachers

Classes Taught	Total Teachers	
	Count	Percent
Secondary Only	71159	99.4
Upper Primary & Secondary	153	0.2
Secondary and Hr. Secondary	289	0.4
Total	71601	100.0

Source: MP State Data

5.3.4.1 Increased Workload

There is no doubt that an imbalance between the demand and supply of teachers affected the teacher's workload in school. In a school with many vacant posts teachers take on extra periods (School principal Government small rural). There were 8 periods per day for secondary classes (Aided small urban) and the school runs for 6.5 hours, out of which an hour is provided for assembly, break and singing of the national anthem at the end of the day (Annexure I).

One principal (Government small urban) pointed out that teachers took classes for the entire day as they only had three regular teachers and all the rest were guest teachers- and the regular teachers

did all the work in the school. According to the qualitative interviews, 25 percent of the teachers reported that they were overloaded with work, while others found the work appropriate or manageable. It was mainly in the larger schools that workload was reported as heavy and teachers ended up taking more than 30 classes per week- probably due to the larger number of sections (Table 45). Four of the teachers were also involved in teaching senior secondary classes (XI-XII). One teacher in a large urban aided school complained that the workload was heavy, there was too much correction work and she had begun to face health related problems due to checking work, which she tried to complete during free periods. Yet another teacher said they could manage the workload but during certain times, e.g. during half yearly and final exams, there was a lot of correction work. During that time it becomes problematic to take classes as well as do correction work (Aided large tribal). The number of classes taken by teachers ranged from 24 classes a week to 42 classes.

Table 45: Teachers Workload

S. No	School type/size/district	Workload is appropriate	Teacher-Periods per week	Daily	Teaching classes
1	Government small rural	Yes	24 periods weekly	4 periods daily	9th and 10th standard
2	Government large rural	Yes	24 classes are taken weekly	2 periods in 10th and 2 in 11th.	10th and 11th Sometimes I teach 9th also but I am OK with it.
3	Aided small rural	Yes	Takes 24 classes in a week	4 classes a day	9th and 10th
4	Aided large rural	Yes	30 classes weekly	5 periods a day	One period in 9th and one in 10th, one in 11th and one in 12th.
5	Government large tribal	Sometimes unmanageable	30 in a week	5 period in a day	9th and 10th standard
6	Government small tribal	Yes		5 periods a day for 3 classes	10th , 11th and 12th one section each
7	Aided large tribal	Manageable	26 class in a week.	4-5 periods a day	10th , 11th and 12th
8	Aided small tribal	Manageable	36 classes in a week.	6 periods a day	He teaches SST
9	Government large urban	Too heavy	42 classes a week	7 periods a day	3 in 9th, 2 classes in 10th and 2 remedial classes a day.
10	Government small urban	Manageable	30 to 36 periods	5-6 periods a day	9th and 10th standard. of Science and Maths in a week
11	Aided small urban	Manageable	36 periods are taught weekly	6 periods a day	Also teaches Sanskrit in 9th.
12	Aided large urban	Too heavy	36 periods a week	6 periods daily	6 periods of general English in 9th.

Source: Qualitative data, 2015

Majority of teachers appeared to be satisfied with their work load. They said that they had time to do other work, had ample time to check copies in school hours, had an hour in the afternoon to do extra work after students left and worked in free periods. The teachers who said they could manage stated that when required teachers would stay back and complete their work or would come to school early to finish additional work and they would finish work at home. One of them said that there was always a shortage of time as lot of checking work was there but she managed all her

responsibilities on time (Aided small urban). These teachers said they were hardworking and passionate about teaching, wanted to create a bright future for children, were dedicated to the school and were completely satisfied with their work. One of them also stated that if teacher are hard workers, they like and accept workload in school (Aided small urban).

During the interviews with principals, it was also revealed that in government schools, besides their regular work, teachers did substitution work for teachers on leave, remedial classes, activities period daily and also helped in Sankul related work (Government large urban). A principal shared that each teacher had been given one or more extra charge other than teaching (Government small rural). Another principal said that they were given other charges according to their abilities (Government small tribal). These included school work related to distribution of scholarships, games and sports, cleanliness and cultural activities, office work, free text book and cycle distribution, laboratory, documents collection, admission work, caste certificate work, board examination work, preparing statistics and data of school and organising Bal Sabhas (children's groups).

However, aided school principals unlike the government school said that no extra work was given to teachers, though they did organise games, cultural activities and competitions, which were all related to their teaching and work was undertaken within school hours. Commenting on the current workload per week for secondary teachers one principal (Aided small rural) said that the workload was five periods a day and that a clerk was appointed for clerical work to relieve teachers of extra workload.

5.4 Teacher Management Processes

The above mentioned analysis of demand of subject teachers has immense bearing on teacher rationalisation and recruitment, because it seems clear that there exist a large number of subject teachers in the state, but they are distributed thinly across a large number of secondary schools (majority of which are very small), spread across the state. Comprehensive planning to ensure that all secondary schools have 5/6 subject teachers seems to be absent. Given the above mentioned situation, we look at issues related to provisioning of teachers, since these may well be related to teacher shortages.

5.4.1 Recruitment and Appointment Process

Teacher appointments and recruitment play a key role in meeting teacher demand. District officials clearly said that policies and actions on recruitment of certain types of teachers and promotion were taken as per the rules and instruction of state government. The state government makes policies and rules while the district does rationalization of subject teachers besides identifying vacant posts.

There are several different teacher cadres in the state - the upper division teachers, Samvida Shala Shikshaks and guest teachers. An internal government report (D. P. Dubey report, 2007) has recommended the consolidation of cadres into the "Adhyapak" cadre, which is being implemented. The state follows the NCTE norms. In order to be appointed in a government school, teachers have to clear the Samvida Patrata Examination (equivalent of TET). The examinations are organized by a professional examination board called Vyavsayik Pariksha Mandal (VYAPAM). Using a web-based system, VYAPAM conducts the selection of all civil servants including the Samvida Shala

Shikshaks.⁸ An advertisement covering vacancies in all the 740 local bodies is done online and through newspapers. The first TET was conducted in 2011 in MP. In this examination, candidates are evaluated on subject knowledge and teaching aptitude. The final selection is based on the marks obtained in TET. Professionally trained candidates get an additional weightage (GOMP, 2014).⁹ At this point, only Samvida Shala Shikshaks are recruited into government secondary schools and these teachers join the Adhyapak cadre after three years of service.

The criterion for selection of candidates includes that the ages of candidates should be between 21 and 35 years old. There exists reservation for female candidates (50 percent) and reservation for persons with disability as per state norms (GOMP, 2014). Women candidates have a ten year relaxation for the maximum age. Guest teachers who have worked for three years in a government school, widows and divorced candidates are provided five years relaxation in maximum age limit. The general categories are required to get 60 percent marks to qualify and the candidates from SC, ST, OBC and persons with disabilities require 50 percent marks. The criteria of selection followed for the preparation of the merit list is that out of a hundred marks a maximum 65 marks are awarded to the candidates in proportion to the marks obtained by him or her in the TET and a maximum of 15 marks awarded for teaching experience in any school (1 year equals 5 marks, 2 years = 10, 3 years = 15). The remaining 20 marks are awarded for professional qualifications in education. Of the Samvida Shala Shikshak Grade II list of candidates in 2011, only 40353 or 11.2 percent of the total candidates (357042) who appeared for the exam passed the exam.

Normally the recruitment takes place every two years and not every year. The last recruitment in MP was done about three years ago after the TET results were declared. According to the recruitment policy for secondary level, 50 percent of vacant posts are filled by promotion recruitment (requiring the same qualifications as direct recruitment), with five years' experience in lower posts (they do not have to give the TET) and 50 percent by direct recruitment (state official interview) i.e. passing State TET. Teachers who are recruited choose the school in which they wish to teach, based on the published list of vacancies. They then submit their documents to be certified by the district appointing authority where the vacancy is located and based on counselling teachers are appointed (RMSA-JRM, 2014).

Teachers from the qualitative sample study reported that they had either been appointed through interviews (7 teachers) or through promotions based on merit (5 teachers). Teachers in aided schools were appointed after a panel interview taken by a panel (including the principal, manager and a senior teacher (Aided large tribal school teacher), or through Samvida committee (Aided large rural school teacher). Teachers in government schools were more likely to be appointed through promotions.

According to a District Education Officer, posts in government schools were filled by departmental promotions of elementary school teachers, since primary and middle school teachers are promoted

⁸ This web-based system is operated through "MP Online Limited," which is an e-Governance initiative of Government of Madhya Pradesh. A unique portal is created to serve various Government Departments. The portal was created through private-public partnership (a joint venture company established by the Government of Madhya Pradesh and TATA Consultancy Services Limited) in 2006.

<<http://www.mponline.gov.in/Portal/AboutMPOnline.aspx>>

⁹ To avoid any legal complications, a Caveat Petition is filed in all three High courts in the state to deal with any kind of legal challenge.

to high schools on the basis of their seniority and qualification. Teachers are recruited according to a roster system that has allocations for different social groups according to the population in the state. Madhya Pradesh's 1994, *Lok Seva Adhiniyam (Anusuchit Jatiyon, Anusuchit Janjatiyon aur Anya Picchade Vargon ke iye Arakshan)* policy reserves teacher posts according to the population of the reserved category in a particular district (general, SC, ST and OBC categories). This is referred to as the "roster system." There is a roster based recruitment system across public service institutions in the state including teachers. Accordingly, the state has a fixed number of places that are allocated to tribal communities. Delays in recruitment was reported by one of the district officials who shared that after sending the demand identified in the schools to the government, they could only hope that the government would take steps to recruit teachers quickly. One of the principals in a government school complained that though he had been assured of being provided teachers through departmental promotions, against vacancies in his/her school which was located in a village area, this had not happened. Though departmental promotions had taken place, teachers had chosen vacant post in the city rather than semi-urban areas. As a result, the school did not have teachers in science, social science, Sanskrit and English. The posts were regular which meant that they could only be filled only by departmental promotion and not directly, or if a teacher took an inter-district transfer.

Government school principals found the norms for the recruitment process at the local level to be quite satisfactory. The recruitment process as decided by the government with the norms and service rules through VYAPAM was considered the best selection process (Government small rural). Another stated that the present system of appointment of Samvida teacher through examination and merit was better than the earlier process and another principal highlighted that s/he did not feel that there was any need to change the recruitment procedure (Aided small tribal).

5.4.1.1. Shortage of Teachers from the Tribal Community

With a significant tribal population in the state, the roster stipulates the proportion of teachers from the tribal community that needs to be recruited each year. For several years the number of applicants from the tribal community is very disproportionate to the needs of the state. For example, in the tribal districts of Jhabua, there is an 85 percent reservation for ST teacher recruitment. It was reported that due to the lack of applicants, 1500 posts remained vacant and the state faced constraints in filling up the roster allocation for tribal districts due to the inadequate number of tribal candidates that apply for these positions.

5.4.2 Ineffective Deployment

The MP Annual Plan 2014-15 states that the "rationalization of teachers is being adopted to ensure adequate number of teachers in all schools. A time bound action plan will be drawn up for the district to direct resources towards single teacher schools and schools in remote areas. This will be done before the onset of the new session (GOMP, 2014)." Given that there exists inter-district and urban-rural disparity in teacher availability, effective and efficient deployment seems to be one of the possible solutions to ensuring that there is a more equitable distribution of subject teachers across schools, particularly those located within remote tribal districts.

The analysis has found that while on the one hand, 98.2 percent of schools do not have five subject teachers, there exist 2 government schools located in Indore and Burhanpur with zero students and a total of 143 schools in the state have zero to 10 students enrolled in secondary

classes (Table 46). It is clear from the analysis above that private unaided schools seem to have the largest number of small schools (127 schools) and occupy 88.8 percent of schools with less than eleven student enrolment in the state.

Table 46: Number of Schools with Zero –Ten Enrolment

District Name	GOVERNMENT	Aided	Unaided
ANUPPUR	-	1-	2
BARWANI	-	-	2
BETUL			9
BHOPAL			18
BHIND		-	3
BURHANPUR	1	-	-
CHHINDWARA	-	-	2
DATIA	1		5
DEWAS	-		3
DHAR			4
GUNA			5
GWALIOR	1		11
HARDA			4
INDORE	3		2
JABALPUR			1
KHANDWA			1
KHARGONE			3
MANDSAUR			2
MORENA	-	-	6
NARSIMHAPUR			7
NEEMUCH	-	-	3
PANNA	2	-	-
RAISEN	-		2
RAJGARH			4
RATLAM			2
REWA			4
SAGAR			4
SEHORE	-	-	1
SEONI			2
SHAHDOL	1		2
SHAJAPUR			2
SHIVPURI	-	-	2
SIDHI	2		-
SINGRAULI			1
UMARIA	1		-
UJJAIN			1
VIDISHA	1		1
Grand Total	16	0	127

Source: MP State Data

While there are only 16 government schools with student enrolment ranging from 0-10 students, there are 40 teachers who are reported to be recruited in these schools. The situation calls for a deeper analysis of deployment of teachers within the government schools. The Third RMSA-JRM pointed towards “an imbalance of teacher distribution across schools. One, the urban schools had mostly regular teachers, while the rural schools had more contract teachers than regular. Two, the rural and remote schools face acute shortage of math, science and English teachers and there was prevalence of guest teachers in these schools (RMSA-JRM, 2014).” The mission specified that rural schools and those located in tribal areas have more guest teachers in critical subjects like science and math, and there were huge vacancies of women and SC/ST teachers. Given that the state does not have a transfer policy to address inter-district teacher movement and in the past only women and persons with disability could apply for transfer. It is important to revisit the transfer policy since teachers also lose their seniority once they take a transfer teacher deployment in the remote tribal areas and backward blocks.

5.4.3 Sanctioning of Posts

While the MP Government is not sanctioning any new teacher posts in aided schools any longer, all government vacancies need to be sanctioned by the Department of Education. A state official shared that aided schools were not being given new posts and slowly those with large number of sanctioned posts were being taken over as government schools. Aided schools have a case in Supreme Court since they want VI Pay Commission salaries (state official).

The norm for recruiting teachers in secondary schools is based on 6 subject teachers for secondary school. (*Hindi, English, Sanskrit, Maths, Science & Social Studies*) with 160 students i.e. 2 sections each in Grades IX and X of 40 students.

With increase in school size and sections the norm for sanctioning additional teachers is as follows:

- 1) 200 students to get an extra Maths teacher
- 2) 240 students to get an extra English teacher post
- 3) 280 students to get another Science teacher
- 4) 320 students to get another Social Studies teacher
- 5) 360 students to get another Sanskrit teacher
- 6) 400 students to get another Hindi teacher

A state official shared that a new norm has now been proposed for composite Secondary and Higher Secondary schools. In Higher Secondary earlier 8 teachers used to be sanctioned, now by merging the two sections, 6 teachers are sanctioned for secondary and 3 for Higher Sec (based on stream offered). Upper Division Teachers (UDT) are now being phased out and it is proposed that Post Graduate Teacher (PGT)/lecturers or Grade 1 teachers will teach both secondary and higher secondary schools. This seems a very positive policy change and will lead to better utilisation of teachers within composite schools consisting of secondary and higher secondary classes.

Though only 27000 posts are reported to be lying vacant in secondary schools, it is apparent from the analysis that the current number of sanctioned posts is far from appropriate. One of the state officials mentioned that *‘there are schools with less student populations and for this we should not follow the 5 km radius norm for secondary schools. We should be merging schools.’*

The number of teachers posts in schools are sanctioned on the basis of calculation of number of students/sections in schools in the year 2011. Thus even though norms are prescribed sanctioning of new posts is very irregular and no new posts were being given/sanctioned to schools with a higher/more student population. A total of 9965 posts were last sanctioned under RMSA in 2011-12, after that no new posts have been sanctioned (state official). There was a time when Zero Budget Schools were opened (2006-07) without any teaching posts sanctioned, but that had now been regularised (state official). One of the teachers also complained that teacher shortage was because government was not sanctioning teacher posts and vacancies were being filled by the guest faculties. The salary of the guest teachers came from the government so the government was aware of the shortages and yet teachers were not appointed, since posts were not sanctioned (school teacher).

5.4.3.1 Budget Constraint a Major Factor for Non-Sanctioning of Posts.

It is evident that non-sanctioning of posts is a key factor that can be attributed to subject teacher absence at least in government schools. One of the officials shared that *'even if we go to state asking for sanctioning new posts, they will not allow due to financial constraint. GOI also does not give full salary of teachers they have sanctioned. Only new schools are getting sanctioned posts and it will take 2 years before teachers are appointed in these schools.'*

The state has filled 8900 teacher posts so far (sanctioned in 2011), because RMSA only gives part of the salary (Rs 19000) and rest has to be contributed by the state. Financial issues remain a major impediment to sanctioning of new teacher posts. The last direct recruitment of teachers was undertaken by the state in January to February 2013 (state official). One of the state official shared that *'the state requires more sanctioned posts, since only 363000 teaching posts have been sanctioned (primary-senior secondary) and actual demand e.g. taking into consideration high school norms i.e. minimum of 8 teachers should be about 7 lakhs sanctioned posts'*. This is clearly a huge challenge for the state and the state has to plan how to address this shortfall of sanctioned posts required to support schools meet the RMSA norms.

5.4.4 Emerging Concerns & Recommendations Regarding Teacher Demand in MP

1. Schools Not Meeting Subject Teacher Norm

It is clear that there are an exceedingly large number of vacancies based on the state norm of 6 subject teachers per school with 160 student enrolment. While private unaided schools seem to have a greater shortage of subject teachers, meeting the five subject teacher norm is being met by less than 2 percent schools in the state.

2. Shortages of Subject Specialists Particularly in Tribal Areas

The analysis highlighted the shortage of English, Maths and Science teachers particularly in tribal dominated areas. The roster system does not allow other social category of teachers to be recruited in tribal areas and this causes huge challenges in recruiting teachers against sanctioned posts in tribal dominated districts.

3. Inadequate Sanctioned Posts of Secondary Teachers

While a very small number of sanctioned posts in government schools remain vacant, there is a larger issue of inadequacy of sanctioned posts that needs to be addressed. The current shortfall of subject teachers is leading to a large number of guest teachers being employed and

accountability of guest teachers is a matter of serious concern at secondary level, where students need to clear their Board exam in Grade X.

4. Transfer Policy and Deployment

It would be difficult for MP to address equitable teacher distribution, unless there is some kind of teacher transfer policy that supports inter district transfer. Similar to teacher recruitment, both state and district teacher deployment and transfer policies would need to be transparent and easily implementable, ensuring intra-state equity and effective teacher distribution. Analyzing the level of unequal district-wise distribution would be a useful exercise to estimate whether within-district transfers are adequately taking place based on school requirements. A teacher transfer policy at the state level could also address the lack of teacher in tribal and rural areas providing a list of incentives for surplus teachers to make short term commitments to move to these locations. Career development and promotions could be based on such transfers. Salary bonus, housing, scholarships for teacher's children, transport facilities could be considered as incentives that accompany this transfer.

5. Building Efficiency in Secondary Schooling

Approximately 60 percent of secondary schools in MP have less than 160 student enrolled. This fact raises issues related to whether it is financially feasible and administratively efficient to appoint core subject specialists irrespective of student enrolment given the distribution of schools in MP. The policy option of clustering small schools with less than 100 students or connecting small schools with a larger school with shared core subject specialist teachers could be explored at least within government schools. In this way, secondary schools will be able to get requisite number of teachers without undue wastage of human resources. Given that 127 private unaided schools and 16 government schools have student enrolment between 0-10 students, the state needs to also regulate unaided schools to ensure that they comply with subject teacher norms.

5.5 Supply of Teachers in Madhya Pradesh

A Perspective Plan for teacher education has been prepared by the State. Approximately 516 organizations were offering 533 B.Ed. courses with a total of 47202 seats in 2014-15. Eleven of these organizations appear to be offering two courses. The RMSA-JRM noted that with "500 private teacher education institutions", private participation in the state at teacher education level is also high (Third RMSA-JRM, 2014).

Table 47: B.Ed. Admission Count Category/Gender/Year Wise

	2013-14	2014-15
Female	Nil Session	26787
Male		20415
tal		47202
OBC		15706
SC		7374
ST		4005
General		20117
Total		47202

Source: MP Higher Education

As seen in Table 47 the academic year 2013-14 was declared a zero year since the session of 2012-13 B.Ed. course ran almost a year behind the schedule. This was despite Supreme Court instructing the state governments and the NCTE to streamline B.Ed course and issuing a schedule for strict compliance in its order dated December 13, 2012.¹⁰ However, due to the delayed academic session of 2012-13, the state government in August 2013, passed an order stating that it is impossible to adhere to the schedule for session 2012-13 and provide 200 mandatory days of teaching due to delayed admission schedule of teacher colleges. Thus MP Higher Education department declared 2013-14 session as a zero year and directed NCTE and colleges to meet the timeline issued by the apex court from session 2014-15 and onwards. Since the 2012-13 session was delayed considerably, the results of this batch was made available only in 2014-15.

5.5.1 Student Enrolment in Colleges of Teacher Education

There were approximately 567 B.Ed. colleges in the state affiliated to ten Universities in 2015 (State official). The current study captured supply data from 533 colleges (Table 48) by visiting Universities and collecting the supply side data for each of the colleges, based on subjects students had taken in their methods paper. This information was not available with neither the NCTE nor the Higher Education Department. While the Higher Education Department provided details of number of students enrolled, Universities were unable to provide methods papers the students had taken up for the current year and therefore the analysis is limited to the data collected for previous academic sessions.

Regarding reservations in seats in college of education, a NCTE official explained that reservation is as per state government norms and students need only 50 percent to get a seat in a B.Ed. college. A state official explained that there were two kinds of reservations for B.Ed. seats (1) 75 percent seats are reserved for state domicile and 25 percent for outside candidates. If 25 percent not filled, they can be filled by local candidates (2) Reservation for SC/ST candidates and they only have to pay Rs 5,000 after getting selected and can pay rest from scholarship amount before the examination. The official further highlighted that these seats reserved for social categories could not be filled by any other category.

Table 48: List of Universities Covered in Supply Side Data of MP

S.No.	Name of the University	District	Data Availability			
			2011-2012	2012-2013	2013-2014	2014-2015
1	Jiwaji University	Gwalior	Yes	Yes	Nil Session	N/A
2	Amicable Knowledge Solution University	Satna	Course not started	Course not started	Course not started	Yes
3	Barkatullah University	Bhopal	Yes	Yes	Nil Session	N/A
4	Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya	Satna	Yes	Yes	Nil Session	Yes
5	Devi Ahilya Vishwavidyalaya	Indore	Yes	Yes	Nil Session	N/A
6	Awadhesh Pratap Singh University	Rewa	Yes	Yes	Nil Session	N/A
7	Rani Durgavati Vishwavidyalaya	Jabalpur	Yes	Yes	Nil Session	N/A
8	Vikram University	Ujjain	Yes	Yes	Nil Session	N/A
9	Dr. Hari Singh Gour University	Sagar	Yes	Yes	Nil Session	N/A
10	Bhoj Open University	Bhopal	Yes	Yes	Yes	N/A

Source: Quantitative Data Collected from Universities in MP

¹⁰ Supreme Court WP Civil 276/12 dated 13/12/2012.

Seats Filled in Colleges of Teacher Education by Streams

As mentioned earlier, data regarding students enrolled in colleges of education was gathered from 10 Universities. There has been an increase in the number of candidates admitted from 2011-2012 to 2012-2013. However 2013-2014 remained a zero year, except for seats filled by government colleges which ran the B.Ed. for in-service teachers and the number of teachers passing out in that year are therefore limited to only 1289 teachers. Data related to the academic session 2014-15 remained incomplete in terms of students passing out by subject specialty, therefore the analysis for Madhya Pradesh supply is limited to 2011-12 and 2012-13.

Table 49: Number of students admitted

Academic Year	Admitted (N)
2011-2012	34770
2012-2013	39101
2013-2014	1289
2014-2015	47202*

*Higher Education MP

While two principals (Private rural & urban colleges of education) stated that there were a sufficient number of teacher training colleges in cities in the state. One of these principal (private urban) further stated that with the number of new colleges opening up, the number of teacher training colleges maybe in excess. However, this was not the case in tribal areas and the principal of a private tribal college stated that there was a shortage of teachers training colleges and trained teachers in whole of the tribal district. A higher education official of the state also confirmed that there was an accumulation of B.Ed. colleges in cities.

With regards to allocation of seats in their colleges, the government college principals elaborated that their seats were reserved for untrained in-service teachers of six districts and all the seats were filled. The process of admission in these colleges was through the DEOs of the districts, who sent the list of teachers to the colleges based on seniority of teachers, who were admitted thereafter. Thus all the seats in the government training colleges were filled with already serving untrained teachers, who were sent on deputation by the district officials. Two principals (Private rural & urban) further expressed a concern about the vacant seats in their colleges in the current academic session, stating that very few seats had been filled in their colleges for the newly introduced two year B.Ed. course in 2015-16.

5.5.1.1 Gender Differences

It is clear from Table 50 that more girls join B.Ed. course compared to boys and the former occupy approximately 63 percent of student share.

Table 50: Year & Gender wise Total Passed Students

Year	Male	Female
2011-2012	9308	16835
2012-2013	10547	17800

Source: Supply Study 2015

One principal (Private rural) stated that 50 percent seats were reserved for women and they were filled up regularly. Three principals stated that there was no gender imbalance in admissions. Only one principal (Private urban) commented that more women took arts subject, hence their numbers were higher.

5.5.2 Pass Percent of B.Ed. Students by Stream

Analysis of the supply side data collected from the Universities in MP, highlighted that close to three-quarters of the seats were filled by Arts students for both the academic years. While the pass percent of students in 2011-12 was 89.5 percent, with the majority of students belonging to the Arts stream i.e. 72.5 percent (Table 51). The state official clarified that there was no allocation of seats according to subjects and this was true for all the northern states. All Principals interviewed during the qualitative study also stated that there was no subject wise reservation.

Table 51: Total Number of Passed B.Ed. Students by Stream in Madhya Pradesh

Academic Year	Total Number of Admitted Candidates			Total Number of Pass-Out Candidates		Percent of Pass-Out Candidates	
	Admitted (N)	Pass-Out (N)	Fail (N)	ARTS	SCIENCE	ARTS	SCIENCE
2011-2012	34770	31141	3629	22586	7981	72.5	25.6
2012-2013	39101	33511	5590	23971	9260	71.5	27.6

Source: Supply Study 2015

5.5.3 Supply of Subject Teachers

Given that B.Ed. candidates choose two methods or specialization papers, the supply data capture forms provided information about subject specialization besides streams that the students pursuing B.Ed. had undertaken. This information was not available with NCTE or Higher Education Department of MP and is one of the most critical pieces of information to inform the supply of teachers.

5.5.4 Pass Percent of B.Ed. Students by Subject Specialization

As mentioned earlier three out of every four students had taken up Arts stream. Further analysis of the methods papers chosen by teacher trainees, reveals that the largest number of pass-outs took up Language with social studies, followed by language and science and then language and mathematics (Table 52). Pure science in both 2011-12 and 2012-13 constituted only less than 8 percent, highlighting the limited number of candidates that are taking up science and therefore explaining the shortage expressed by respondents about science teachers. In the two academic sessions candidates who took up languages and social studies combination constituted 58 and 55.3 percent, followed by language and science combination (20.2 and 21.2 percent). The next highest category was of language and mathematics (11.9 and 14.5 percent). A limitation of the data was that the specific language subject that teachers had chosen e.g. Hindi, Sanskrit or English was not captured. The number of students taking up science and mathematics remained small.

Table 52: Year & Subject wise percent of Total Passed Candidates (percent) in BEd in MP

Academic Year	Language /Science	Language /Social Studies	Language/ Mathematics	Social Studies	Science/Science	Any Others	Total
2011-2012	20.2	58.0	11.9	1.9	7.9	0.2	100.0
2012-2013	21.2	55.3	14.5	1.3	7.5	0.2	100.0

Source: Supply Data, 2015

Qualitative interviews with principals of private and government colleges of education in the three sample districts highlighted the shortage of students taking up English, Mathematics and Science. While one principal (Government rural) stated that mainly there was a shortage of candidates taking up English, Science and Mathematics teachers, another principal (Private urban) commented that the college was not getting teachers for Physics, Mathematics and English since the last few years. This was due to the fact that these subjects were considered to be difficult and students did not opt for them (Government college principal, rural). Trainees in private colleges explained that only brilliant students chose Science since it was a difficult subject to learn (private tribal). Science students according to them entered other fields or technical/professional courses and they had more career options and job opportunities, while the humanities students were left behind to choose B.Ed.

5.5.5 Job Preferences After Completing B.Ed.

It is evident from the above analysis that 64654 teachers successfully completed their B.Ed. between 2011-12 and 2013-14. Since we cannot assume that every teacher would join secondary schools after completion of the course, teacher Trainees were interviewed during the qualitative research to seek reasons why they had joined the B.Ed. degree course and their future plans. Majority of the students during the group interviews expressed that motivation to join B.Ed. was self-driven or that they had been influenced by their family members.

All the teachers studying in government colleges shared that completing B.Ed. was compulsory for a teaching job as also for professional development to '*move ahead in the teaching line*', and the added qualification was an advantage. The majority of pre and in-service trainees agreed that after completing B. Ed there was a scope of better employment and good career opportunities. The in-service government teacher trainees would return to their respective schools after completing the course. In-service teacher trainees stated that teaching techniques learned during the course would help in teaching more effectively and thus improve students learning. They also expected better career opportunities and further promotions to come their way.

Three principals (Private urban, rural & tribal) were of the opinion that the teacher trainees were interested in government jobs and 60 to 70 percent of the students would opt for government jobs. However CTE principals also said they couldn't predict where students would go (Private rural) since there were a limited number of teaching posts in the government (Private urban). The government college principal also shared that some trainees wanted to pursue higher education after B.Ed.

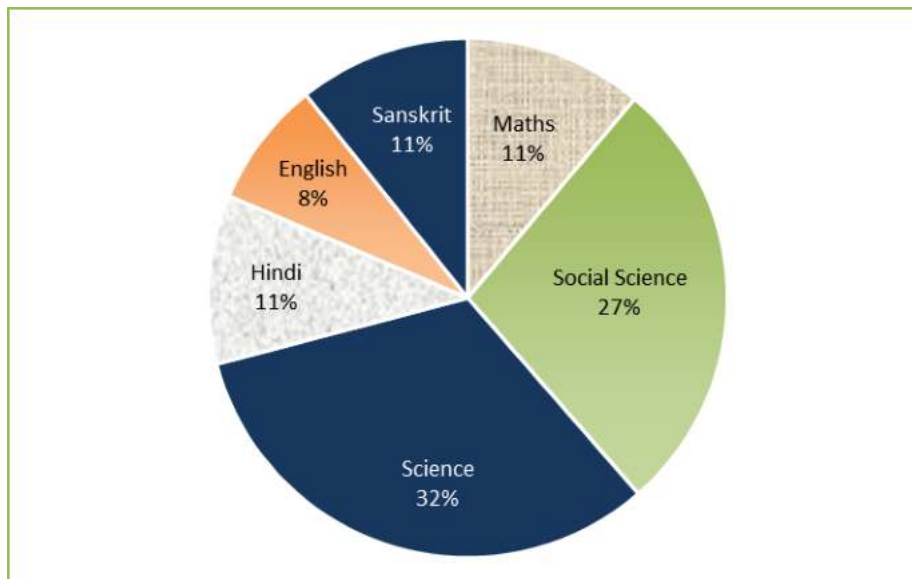
Participated trainees in the focus group interviews expressed a preference for government school or college jobs as they were thought to be more secure, they could not be expelled, salary was good, higher status was associated with these jobs and some said they wanted to serve the poor people by educating their children who primarily studied in government schools. One of the trainees (private rural) expressed preference to join a private school as their '*salaries were based on teaching skills*

(on performance) and by developing ones teachings skills one could draw a good salary'. Another trainee (private rural) stated that whichever school paid better would be the school of choice. One of CTE principal (Private urban) shared that students from their college had been employed by leading private schools and colleges of Bhopal and the state, with good salary and service conditions. Currently students were opting for private missionaries' institutions. Teacher trainees shared that they would apply in private schools only if they were not selected or if they didn't get a government job. Private school jobs were not preferred as jobs in these schools were considered to be insecure, private schools were thought to be stricter, with fewer holidays and required teachers to work harder. While trainees from the tribal district CTE stated that there was a shortage of teachers in their district and thus there were more job opportunities in government sector. Another trainee (government urban) expressed the fear that it was not necessary that one would get a job after completing B.Ed.- signaling the insecurity teacher trainees were facing in terms of getting employment.

5.5.6 Teacher Eligibility Test

It is important to analyse the results of the most recent Teacher Eligibility Test results in 2011 to understand the supply of teachers by subject. The TET result based on the distribution by subject specialization of those who passed is given in Figure 21. Surprisingly 32 percent of those who passed the test were science teachers, followed by 27 percent social studies teachers. It is evident that the number of mathematics teachers eligible for recruitment remained a low 11 percent and English teachers constituted only 8 percent of those who passed the TET exam.

Figure 21: Percent subject teachers passing TET in 2011

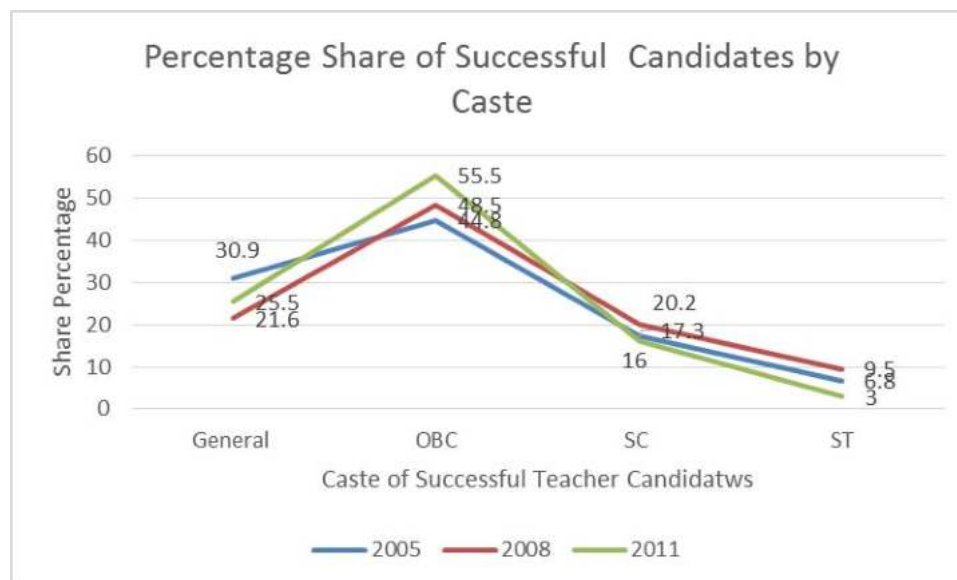


Source: VYAPAM

Further analysis of social categories of qualifying applicants of the state TET (Fig 22) shows that while there is a steady increase in the share of candidates qualifying the teacher eligibility examination since 2005 from the OBC group, the share of applicants from the ST community has steadily decreased from 9.5 percent in 2005 to only three percent in 2011. Further analysis of the 2011 VYAPAM data, reveals that amongst the three percent ST candidates (N-1252), 44 (3.5 percent) were mathematics teachers, 489 (39 percent) were science teachers, 433 (34.5 percent) were social

science teachers, 83 (6.6 percent) Hindi teachers, 113 (9.0 percent) English, 91 (7.2 percent) Sanskrit teachers. It is obvious that the current number of qualifying ST teachers are applying for various districts across the state, but even the entire number of ST teachers are insufficient to fill up the existing vacant posts even in one particular district such as Jhabua , where 1500 vacancies for ST teachers exist. Furthermore, the small number of mathematics and language teachers, will not help in filling the reserved seats that remain vacant.

Figure 22: Percent share of Successful Teacher Candidates passing TET by Caste in 2005, 2008 and 2011



Source: VYAPAM

5.6 Challenges for Supply of Secondary Teachers

Drawing upon both quantitative and qualitative evidence, challenges in supply of teachers in MP is given below. One of the limitations in the data is the lack of desegregated data on language teachers.

5.6.1 Subject wise shortages of teachers

Given that close to 50 percent of the B.Ed. students took up language with social studies and another 25 percent took up language with science, it seems that language teachers are in sufficient supply. However, we do not know which language these teachers took up and relying on the qualitative interviews we assume that very few students take up English language. This is confirmed by the TET data which shows that only 8 percent of passed candidates are English teachers. The fact that very few students were opting for science, mathematics and English was reported by both principals and teacher trainees in the interviews. Very few students seem to be taking up pure science (approximately 8 percent). If this trend continues there would be a shortage of science teachers in the near future.

5.6.2 Absence of Reservation of B.Ed. Seats by Stream Leading to Excess of Arts Teachers

Both state official and college principals clarified that there was no allocation of seats according to subjects and this was true for all the northern states. The quantitative and qualitative data point to the disproportionate number of students opting for Arts subjects instead of Science.

5.6.3 Shortage of ST candidates Entering the Teaching Profession

Given that a large number of sanctioned posts in tribal districts remain vacant, it is critical that tribal students are provided incentives to join B.Ed. and coaching provided to them to qualify for TET. Scholarships to students to encourage them to take up subject specialisations where there is a specific shortfall based on demand and supply analysis in each district, would also prove useful.

5.6.4 Compatibility of TET with B.Ed. Curriculum

The number of students sitting for the state TET, as reported by college principals, varied from 12 to 15 percent in private urban college to about 80 percent in private tribal college. Most trainees felt that B.Ed. course prepared them for the TET, because approximately 50 percent of the questions were from the course. However a private college principal from the tribal dominated district expressed that the curriculum did not prepare teachers for the TET and the curriculum of B.Ed. had no relation with the examination. This may require further study and TET is to be reviewed to ensure that there is compatibility between what is taught in B.Ed. and what is tested in the TET.

5.6.5 Admission Process

The state official stated there was an issue with delays related to B.Ed. admissions in the state. Ideally admissions should be over before July when the session should begin, but colleges did not always follow this timeline. However CTE principals (Private urban) commented that admission in B.Ed. course was done as per government rules. The Higher Education Department of the state government provided the college with a list of the admitted candidates and they did not have any role in the admission process (Private urban).

Other issues identified were that the entrance exam paper was too easy and that it should be made more difficult in order to choose the most deserving candidates to join B.Ed.

5.6.6 High Fees in Private Colleges

Another issue that was highlighted by students pursuing B.Ed. was that the fees of the private colleges were too high. This was refuted by a private college principal who explained that due to government policies they did not earn much money from the college (Private tribal). They complained that departmental control over the admission procedure led to many of the seats being left vacant. This led to a loss for the management as each candidate admitted to the college pays a large sum of money to the CTE.

5.6.7 Allotment Challenges

One of the difficulties identified were related to allotment process. For instance a principal (Private tribal) elaborated that due to selected candidates allowed to choose from amongst the various colleges in the state, they did not get many science graduates from the local area, because his college was situated in a tribal area. Science trainees in the college were outsiders and primarily girls, and there was a greater likelihood of them getting married and moving out of the district. The

principal therefore felt that science teachers would remain in short supply in the district and there was a need to change the allotment process. The suggestion was that colleges should have power to fill the seats by candidates from their district but this would require amendments in rules by state government.

5.6.8 Two Year B.Ed. Posing Further Challenge to Filling Seats

An NCTE official explained that the two-year B.Ed. introduced in 2015 had led to a large number of seats being left vacant. According to him vacant seats were reported to have increased to 20,680 vacant seats in the academic session 2015-16. Another state official agreed that there had been a huge drop in enrolment after 2-year B.Ed. has been introduced. S/he explained that the reason could be the student's preference to do a Masters in two years, rather than a two-year B.Ed. The inability to pay fees for two years instead of one was another reason cited for the low enrolment. The qualitative research captured the number of students enrolled in 2015-16 in the sample private and government colleges (Table 53). It is clear that government colleges had filled all seats due to the fact that they were admitting in-service teachers, while some of the private colleges had a large number of vacant seats, particularly in private urban college which had 90 percent of the seats left vacant.

Table 53: Seats filled in CTEs in MP

CTE Type and District	Total seats	Filled seats
Government rural	120	120
Private rural	100	48
Government tribal	-	-
Private tribal	100	99
Government urban	150	135*
Private urban	100	10

**15 seats are reserved for candidates from Andaman and Nicobar Islands*

5.6.9 Lack of Data on Subject Teacher Preparation

The state/regional level official stated that there was no information available about specific data related to subject teacher preparation in the state, e.g. the percent of seats filled by University. Some information/data related to admissions was available only due to a recent Parliament questions that had been raised regarding the number of teachers who had enrolled in teacher colleges in the past two sessions.

5.6.10 Importance of Evidence for Planning for Balancing Demand and Supply

The state/regional level official agreed to the necessity to collect evidence about demand for secondary teachers by subjects in the state for the next five to ten years, in order to plan for any surplus or short supply of specific subject teachers. The NCTE official stated that the previous study on teacher supply and demand conducted by NCTE had given them some direction and they felt that such a study was extremely useful. The official also stated that a Review Commission under Chairmanship of Prof Saddiqui had been constituted to look into teacher preparation, and hoped that many issues related to teacher preparation would be resolved.

5.7 Projection of Teacher Demand in Madhya Pradesh

Based on the Demand and Supply Model developed for secondary school projection, we analyse the teacher paucity in core subjects across school types in Table 54. The analysis looks at availability of a minimum of two language teachers, one mathematics teacher, one social studies teacher and one Science teacher per school. The analysis does not take into account other subject teachers such as Arts, Physical Science etc. The subject teacher requirement was calculated by taking into account that 55 percent of the schools had only one section each in Grades IX and X, while 45 percent of schools had more than one section per class according to the MP School data collected for 2014-15. The state norm for sanctioning additional teachers was also taken into account. The analysis also takes into consideration the number of retiring teachers i.e. replacement demand based on the analysis provided in section 5.2.1.4.

Table 54: Teacher Demand 2014-15 in MP

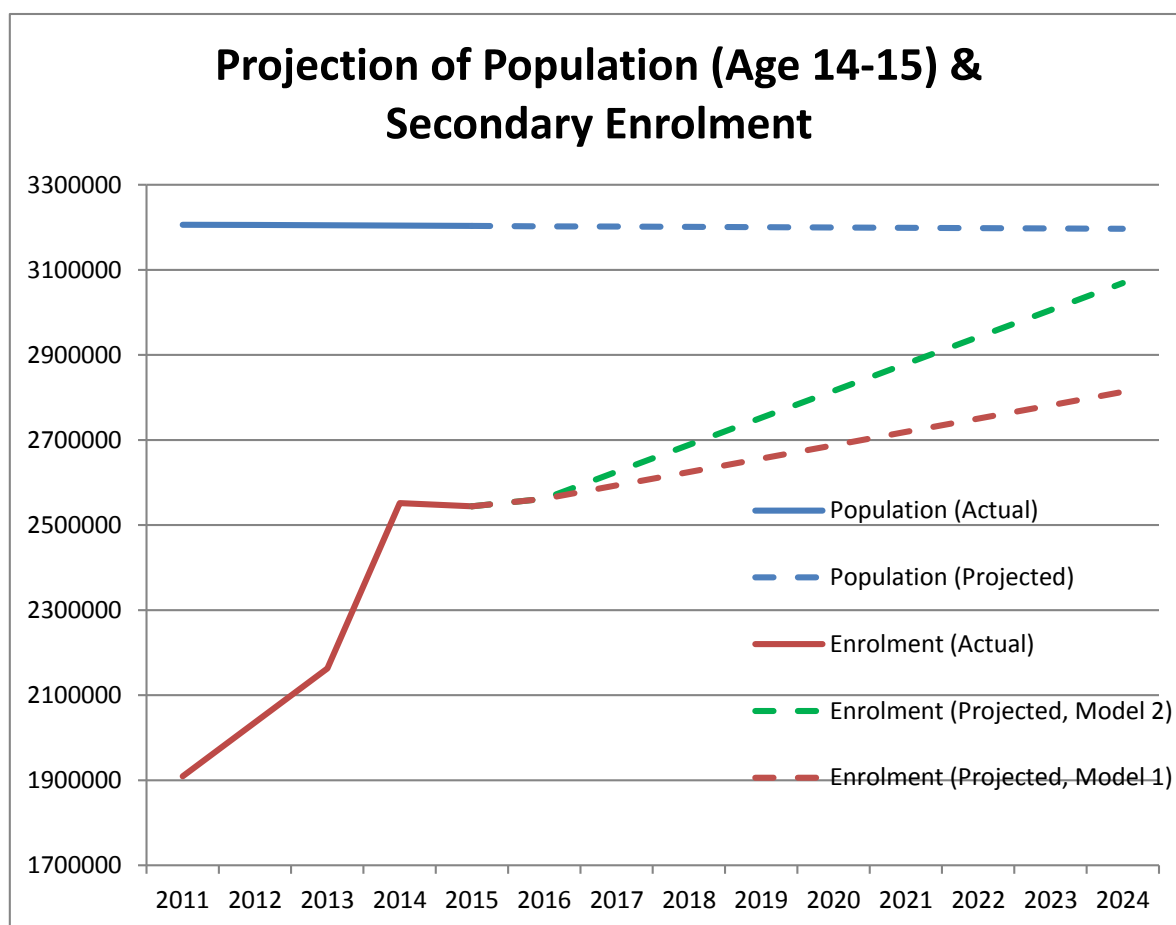
	2 Languages	Maths	Social Sciences	Science	Total
Government	14946	3432	2167	2365	22910
Private Aided	428	134	146	134	842
Private Unaided	9175	2780	3136	3046	18138
Sum	24549	6346	5450	5545	41889
Replacement demand	112	43	138	58	351
Total	24661	6389	5588	5603	42240

Table 54 shows that MP currently requires 41889 subject teachers to fill up the existing subject teacher vacancies across school management types. Government schools require a total of 22910 teachers while private unaided schools have a shortfall of 18138 teachers. Language teachers are obviously in greatest demand since we have taken two language teachers in the analysis. With reference to other subjects, mathematics teachers are in greatest demand and a total of 3566 maths teachers are required for government and aided schools, whereas 2780 teachers are required in private unaided schools. On including replacement demand, a total of 42240 teachers are in shortfall in 2015 across all school managements.

5.7.1 Projection of Teacher Demand for Next Ten Years

The projection of teacher demand of 5 core subject teachers (Fig 21) reveals that the population in the age group 14-15 years is projected to decline till 2024. These figures are based on population projections made by MHRD¹¹. We show two models based on enrolment rates estimated at Gross Enrolment Ratio of 88 in 2024 (Model 1) and GER of 96 (Model 2).

¹¹ http://mhrd.gov.in/statist?field_statistics_category_tid=163

Figure 23: Projection of Population and Enrolment from 2016-2024

While the total demand of subject teachers is 49549 in 2015, taking into account the number of sections across schools, the demand analysis of subject teachers in 2014-15 which revealed e.g. that 42.6 percent of schools had two language teachers (Table 34) and the replacement demand (Fig 20), we have projected subject teacher demand till 2024 using the two models mentioned above i.e. attainment of GER of 88 and 96 respectively. Model 1 (Table 55) shows that the teacher demand increases by 5030 from the base year of 2015 whereas Model 2 (Table 56) shows an increase of 9922 teachers in 2024 as compared to demand in 2015. Despite demographic decline, increasing enrolment patterns show a consistently rising demand for teachers across subjects till 2024 in the state.

Table 55: Model 1 Projection for Core Subject Teacher Demand in Madhya Pradesh 2015 to 2024

Year	2 Languages	Maths	Social Studies	Science	Replacement	Total
2015	24549	6346	5450	5545	351	42240
2016	24721	6390	5488	5584	395	42579
2017	25025	6469	5555	5653	553	43255
2018	25328	6547	5623	5721	750	43969
2019	25631	6626	5690	5790	588	44325
2020	25934	6704	5757	5858	695	44949
2021	26237	6782	5824	5927	651	45422

2022	26540	6861	5892	5995	746	46034
2023	26843	6939	5959	6063	820	46624
2024	27145	7017	6026	6132	950	47270

Table 56: Model 2 Projection for Core Subject Teacher Demand in Madhya Pradesh 2015 to 2024

Year	2 Languages	Maths	Social Studies	Science	Replacement	Total
2015	24549	6346	5450	5545	351	42240
2016	25157	6503	5585	5683	395	43322
2017	25765	6660	5719	5820	553	44518
2018	26372	6817	5854	5957	750	45751
2019	26980	6974	5989	6094	588	46626
2020	27587	7131	6124	6232	695	47769
2021	28194	7288	6259	6369	651	48760
2022	28800	7445	6393	6506	746	49890
2023	29407	7602	6528	6643	820	50999
2024	30013	7758	6662	6779	950	52163

Given that Madhya Pradesh currently has a total of 516 organization offering 527 B.Ed. courses with a total of 47,202 seats in 2014-15, there does not seem to be a supply crunch of teachers in Madhya Pradesh. Even if we extrapolate from the qualitative evidence that around 50 percent of new teachers will join the teaching profession, there is no doubt that the supply is much more than the demand, in light of the fact that approximately 64652 teachers were trained in two academic years alone(2011-12 and 2012-13). Furthermore, though less than a quarter of the teachers have taken up Science and Mathematics as their specialisation, the demand for these teachers would be met.

However, we need to underline that while the supply of teachers seems to be sufficient to meet the demand of subject teachers in secondary schools in the state, that subject teacher vacancies in schools are mainly due to non-sanctioning of posts, lack of effective deployment and recruitment process delays and reservation policies such as roster system in tribal areas rather than shortage in teacher supply. It may be necessary for the state to pay special attention to subject teacher demand in rural and tribal locations by providing incentives not only to pursue B.Ed., but more importantly to encourage students to take up Mathematics, English and Science at Higher Secondary and under-graduate level.

Furthermore, the large number of very small sized schools makes meeting subject teacher norms in schools increasingly difficult. There is a need to urgently coordinate the demand and the supply and analyse admission of students based on subject teacher vacancies in the state. Streamlining the demand and the supply by long and short term planning will support the state to effectively manage its supply of subject teachers and also assure newly trained teachers with job opportunities.

6. Conclusions & Recommendations

It is clear from the analysis that both Karnataka and Madhya Pradesh are experiencing serious shortfall of meeting the RMSA norm of minimum 5 subject teachers at secondary level. While Karnataka has 5.3 percent of secondary schools with the minimum five subject teachers, MP has only 1.8 percent of schools meeting the 5 subject teacher norm. Both states, however, have higher numbers of subject teachers spread across schools. Karnataka had at least two language teachers in 77 percent of all schools, at least one mathematics teacher in 78 percent of schools, at least one science teacher in 72 percent and at least one social studies teacher in 46 percent of the schools. MP, on the other hand, has 43 percent schools with at least two language teachers, 59 percent schools with at least one mathematics teacher, 62.8 percent have at least one science teacher and 62 percent with at least one social science teacher. The following table summarises subject teacher availability in both states.

Table 57. Subject Teacher Availability in Karnataka and MP

	Karnataka	MP
Schools with 5 subject teachers	5.3%	1.8%
Schools with at least 2 language teachers	67.8%	42.6%
Schools with at least 1 maths teachers	63.6%	59.2%
Schools with at least 1 science teachers	61.3%	62.8%
Schools with at least 1 social studies teachers	38.3%	63.1%

Therefore while Karnataka has the biggest shortfall in terms of Social Studies teachers, MP has paucity of language teachers. It is important to note that in both states government schools had better subject teacher availability than private unaided schools and rural schools seemed better placed than urban schools in terms of subject teacher provisioning, though 5 subject teachers are not available across both locations. Evidence of inter-state disparities in terms of specific subject teacher availability also exists in both Karnataka and Madhya Pradesh.

Taking into consideration the current shortfall in subject teacher provisioning across all schools in the two states, the replacement demand and demand based on number of sections in schools, the demand for secondary teachers in Karnataka and MP is estimated in 2015 as 32,228 and 42240 teachers respectively. Given that each of the two states produces more teachers than this demand in the course of two years, it is evident that there are more than sufficient teachers to meet the current demand of secondary teachers in the state.

The projections for teacher demand in the two states till 2024 based on enrolment and population projections does not show any heightened demand for subject teachers that cannot be met by supply from the current colleges of education located in the states.

6.1 Recommendations

The analysis shows that there exists a severe shortage of subject teachers in Karnataka and Madhya Pradesh, only miniscule proportion of secondary schools having five subject specialist teachers available. This fact is often hidden behind the significant number of teachers teaching “all subjects” due to very small size of secondary schools. However, considering that the supply of teachers

exceeds the demand for them, delay in recruitment and lack of policy for deployment and transfer are more of concern than the shortage itself. The study has clearly identified certain areas that need policy attention in order to ensure that there is an equitable distribution of subject teachers across all schools:

1. **Better Teacher Recruitment and Deployment Policies:** While the supply of teachers seems to be sufficient to meet the demand of subject teachers in secondary schools in the states, that subject teacher vacancies in schools are mainly due to non-sanctioning of posts, lack of effective deployment and recruitment process delays and reservation policies such as roster system in tribal areas rather than shortage in teacher supply. Both states need to develop clear recruitment policies and implement them in regular cycles, and flexible deployment policies.
2. **Better Planning to Ensure Demand and Supply Synchronisation:** Streamlining demand and supply by long and short term planning will support the state/s to effectively manage its supply of subject teachers based on teacher demand and also assure newly trained teachers with job opportunities. This will require coordination between the Department of Higher education, NCTE and Department of Secondary Education in each state. This annual planning process should in turn lead to reliable information regarding demand of subject teachers by school management and location to be generated and lead to interventions that ensure the adequate number of teachers are trained in the subjects that are in short supply.
3. **Streamlining Recruitment:** Recruitment processes that are grossly delayed due to court orders and lead to sanctioned posts not being filled needs careful consideration. Alternatives to ensure that students are provided adequate subject specialists such as a pool of trained teachers who can be deputed as guest teachers needs to be planned.
4. **Clustering of Small Schools:** In light of the fact that Karnataka has 61 percent of schools and Madhya Pradesh has 57 percent with less than 160 students, it might be cost effective and efficient to merge small secondary schools in order to ensure that schools are provided adequate human resources. The policy option of clustering small schools or connecting small schools with a larger school with shared core subject specialist teachers could be explored. This way secondary schools will be able to get requisite number of teachers without undue wastage of human resources.
5. **Sanctioning of Posts:** Sanctioning of 5/6 subject teacher posts in each school is essential to ensure that all students are provided subject specialist teachers to provide them the content that they must learn as they prepare for their X Board exams. This is going to be a drain on the state exchequer, but given the fact that no English teaching posts currently exist in Karnataka, financial planning to meet RMSA goals of quality, equity and access must be given priority. Merging small schools could be one step to make schools more efficient, by cutting down costs related to teacher salaries.
6. **Reservation of Seats in Colleges of Education Based on Subject Teacher Demand:** Given that more than 60 percent of teachers take up the Arts stream in both states, it is important to make a reservation or quota of seats in colleges by stream. This would aim towards encouraging students to take up subjects such as Science, language and Mathematics and specific languages , in which there is subject teacher shortage. It may be necessary for the states to pay special attention to subject teacher demand in rural and tribal areas by providing incentives not only to pursue B.Ed.,

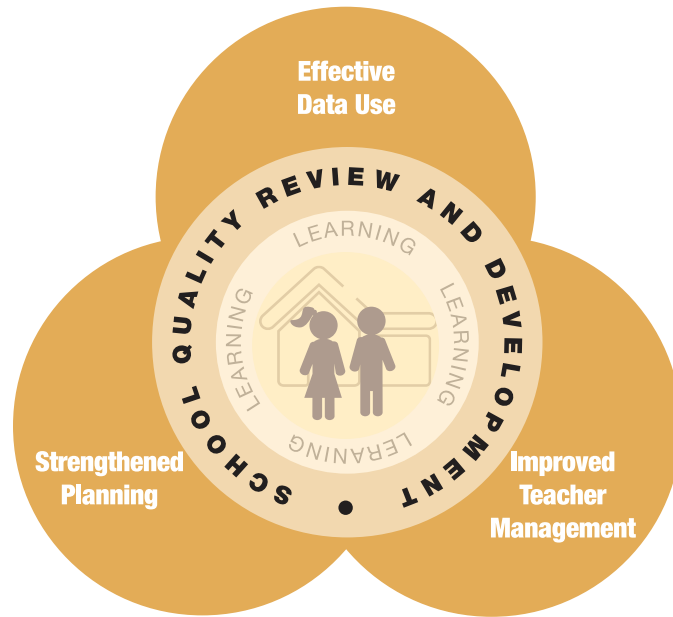
but more importantly to encourage students to take up maths, science and English at higher secondary and under-graduate level.

7. **Strategic planning for meeting demand of teachers in tribal areas:** Given the workforce issues related to roster system prevalent in states such as Madhya Pradesh, a long term strategy to enable students from reserved categories to specialize in critical core subjects at the high school and tertiary levels is required. Short-term strategies include the provision of incentives for teachers from general pool to move to tribal areas for short tenures.
8. **Data Base of Teacher with Subject Specialisation:** In order to inform policy planning, information on subject specialisation of teacher trainees needs to be collected annually by higher education department/s and NCTE and quota for science and arts subjects should be prescribed by the state to meet the demand. UDISE also needs to collect desegregated data on specific language teachers, instead of combining them into one category of 'language teachers'.
9. **Data Base of Supply Pool:** The supply pool must also take into consideration teachers who are unemployed and would be interested in joining the teacher profession. This data base needs to be maintained by the regional committees of the NCTE.
10. **Professional Qualifications:** Unqualified secondary teachers need to be provided adequate training opportunities and HRMIS maintained to ensure that there is no discrepancy between appointment of teachers and subjects taught in secondary schools.
11. **Subject Specialisation:** Given that a large number of teachers may be teaching subjects that they are not qualified to teach, desegregated data at block and district level needs to capture this information, so that unqualified teachers can be added to the teacher shortage data.
12. **Monitor Private Unaided Schools:** Adequate monitoring of private unaided schools needs to be undertaken by states, since they seem to have a large shortage of subject teachers.
13. **No expansion of Colleges of Teacher Education:** In light of the fact that both states have sufficient number of teacher colleges, there is no need to expand the number of teacher training institutions in the states to meet the secondary teacher demand till 2024.
14. **Review of Two-Year B.Ed:** Given that a large number of seats in the two year B.Ed. introduced in 2015-16 have not been filled, it will be important to review the situation in the coming years in order to take stock of the supply of subject teachers and make projections.

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Secondary Education Enhancement Programme

Contact

Room No. 308 - 313, Central Institute of Educational Technology (CIET), NCERT, Sri Aurobindo Marg, New Delhi -110016 INDIA

+91 11 26569925 | contact@rmsatca.org | www.rmsaindia.org

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