DEPARTMENT OF EDUCATION

PROMOTING QUALITY AND EQUITY IN EDUCATION: THE IMPACT OF THE DYNAMIC APPROACH TO SCHOOL IMPROVEMENT

DOCTOR OF PHILOSOPHY DISSERTATION

EVI CHARALAMBOUS

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PROMOTING QUALITY AND EQUITY IN EDUCATION: THE IMPACT OF THE DYNAMIC APPROACH TO SCHOOL IMPROVEMENT

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The present Doctoral Dissertation was submitted in partial fulfilment of the requirements for the Degree of Doctor of Philosophy at the ***Department of Education*** *and was approved on the 23rd of February 2021 by the members of the* ***Examination Committee****.*

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The present doctoral dissertation was submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy of the University of Cyprus. It is a product of original work of my own, unless otherwise mentioned through references, notes, or any other statements.

Evi Charalambous

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EXTENDED ABSTRACT

International evaluation studies have revealed that school failure is more likely to occur in students coming from socially disadvantaged backgrounds, since they tend to have lower grades and drop out of school more regularly than students coming from more privileged families. Reports of the PISA show that above 20% of the European students were low achievers in Mathematics and the great majority of them was found to be in socially deprived areas. Moreover, almost 40% of the variation in student achievement in Mathematics is found between schools within a country and a significant percentage of the variance in student achievement is explained by their socioeconomic background in most European countries. This evidence implies that interventions aiming to improve student learning outcomes at the school level are needed and uncover the need for actively supporting not only *quality* in education (helping students achieve specific outcomes in different learning subjects) but also *equity* (reducing the impact that background factors such as socioeconomic status [SES], gender and ethnicity can have on student learning outcomes). Researchers in the field of educational effectiveness aimed to initially search for factors in relation to the equity dimension since studies revealed that teachers and schools matter most for underprivileged and/or initially low-achieving students. However, gradually the interest of scholars shifted to measure school effectiveness in relation to only the quality dimension. A possible explanation of this, was the fact that the equity dimension was not adequately defined and most researchers assumed that by promoting quality, equity may also be achieved. Consequently, limited evidence exists investigating the relationship between them. However, a number of effectiveness studies have shown that there is a linear relationship between these two dimensions and therefore by promoting equity, quality could also be achieved. Nevertheless, a gap in the research field of educational effectiveness and school improvement exists as to which effectiveness factors can promote not only the quality dimension in education, but also equity. It should be acknowledged that equity in education can be examined in two ways that are closely linked: equity as fairness and equity as inclusion. In this study, equity is seen are related to fairness that suggests that personal and social circumstances, such as SES, gender or ethnic origin should not be an obstacle to educational success.

In this context, the study presented in this thesis aimed to support primary schools in socially disadvantaged areas from four European countries (Cyprus, England, Greece, and Ireland) to use an evidence-based and theory-driven approach to promote their

students' basic skills in Mathematics. This approach (i.e. Dynamic Approach to School Improvement [DASI]) draws on the dynamic model of educational effectiveness which was systematically validated through national and international studies. This dynamic model draws attention to the actions that need to be taken in order to improve the school policy for teaching, the school policy for creating a school learning environment (SLE) and the school evaluation (overarching school factors of the dynamic model) to address both quality and equity. Specifically, schools were supported to develop action plans and strategies based on DASI and according to their settings, to help their students improve their learning outcomes in Mathematics (quality dimension) and also reduce the impact of their students' socioeconomic background on their learning outcomes (equity dimension). To achieve this, primary schools with a high percentage of students coming from low-SES backgrounds in the four countries were invited to participate in the study. Across the four countries, 72 primary schools agreed to participate and these were randomly split into the experimental (n=36) and control (n=36) groups. At the beginning and at the end of the school year 2015-16, Mathematics tests were administered to all students of Grades 4-6 (n=5560) and a teacher questionnaire measuring the functioning of the school factors was given to all teachers of the sample (n=762). A questionnaire measuring SES was also administered to students at the end of the school year. The experimental group made use of DASI, whereas schools in the control group were also supported to develop their own strategies and action plans, but without using DASI. Non-parametric statistical tests were used to test for any significant progress in the performance of each group of schools in relation to the three overarching school factors of the dynamic model. In each country, it was found that only the schools in the experimental group managed to improve the functioning of these school factors at a statistically significant level. Moreover, within-country multilevel regression analyses were conducted to evaluate the impact of DASI and search for interaction effects between the use of DASI and student background factors on final achievement. In each country, the experimental group achieved better outcomes in Mathematics than the control group. At the beginning of the school year, the achievement gap based on SES was equally large in the experimental and the control groups. At the end of the intervention, the achievement gap based on SES became smaller only in the experimental group. DASI was not found to have an effect on equity when the equity dimension was examined by focusing on the achievement gap based on gender and ethnicity. Implications of findings for research, policy and practice are drawn.

EXTENDED ABSTRACT IN GREEK

Διεθνείς έρευνες αξιολόγησης έχουν δείξει ότι το φαινόμενο της σχολικής αποτυχίας είναι συχνότερο σε μαθητές που προέρχονται από χαμηλά κοινωνικοοικονομικά στρώματα, καθώς τείνουν να έχουν χαμηλότερους βαθμούς και να εγκαταλείπουν το σχολείο πιο συχνά από ότι μαθητές που προέρχονται από υψηλότερα κοινωνικά στρώματα. Συγκεκριμένα, αποτελέσματα του διεθνούς προγράμματος για την αξιολόγηση των μαθητών (PISA), δείχνουν ότι πάνω από το 20% των μαθητών δεν αποκτούν τις βασικές Μαθηματικές δεξιότητες και η πλειοψηφία αυτών προέρχεται από περιοχές χαμηλού κοινωνικοοικονομικού επιπέδου (ΚΟΕ). Επιπλέον, σχεδόν το 40% της διακύμανσης των επιδόσεων των μαθητών στα Μαθηματικά βρίσκεται μεταξύ των σχολείων της κάθε χώρας και ένα σημαντικό ποσοστό των διαφορών ανάμεσα στις επιδόσεις των μαθητών των περισσότερων ευρωπαϊκών χωρών, επεξηγείται από το κοινωνικοοικονομικό τους υπόβαθρο. Τα στοιχεία αυτά υποδηλώνουν ότι υπάρχουν μεγάλες διαφορές στην αποτελεσματικότητα μεταξύ των σχολείων της κάθε χώρας και συνεπώς, αναδεικνύεται η χρησιμότητα και η σημαντικότητα παρεμβάσεων στο επίπεδο του σχολείου που έχουν ως στόχο όχι μόνο τη βελτίωση των μαθησιακών αποτελεσμάτων (διάσταση της ποιότητας), αλλά και τη μείωση της επίδρασης παραγόντων του υπόβαθρου των μαθητών (όπως το ΚΟΕ, το φύλο και εθνικότητα) στα μαθησιακά τους επιτεύγματα (διάσταση της ισότητας). Ερευνητές στο χώρο της εκπαιδευτικής αποτελεσματικότητας στόχευαν αρχικά στην εύρεση παραγόντων που μπορούν να προωθήσουν τη διάσταση της ισότητας, καθώς έρευνες ανέδειξαν ότι ο εκπαιδευτικός και το σχολείο γενικότερα έχουν μεγαλύτερη επίδραση στους μαθητές που προέρχονται από χαμηλά κοινωνικά στρώματα ή/και που έχουν αρχικές χαμηλές επιδόσεις. Ωστόσο, σταδιακά το ενδιαφέρον των ερευνητών στο χώρο αυτό, μετατοπίστηκε στη μέτρηση της αποτελεσματικότητας του σχολείου σε σχέση μόνο με τη διάσταση της ποιότητας. Μια πιθανή εξήγηση για αυτό, είναι το γεγονός ότι η διάσταση της ισότητας δεν είχε οριστεί επαρκώς και οι περισσότεροι ερευνητές υπέθεσαν ότι προωθώντας την ποιότητα στην εκπαίδευση, μπορεί ταυτόχρονα να επιτευχθεί και η ισότητα. Κατά συνέπεια, οι έρευνες που διερευνούν τη σχέση μεταξύ των δύο αυτών διαστάσεων είναι περιορισμένες. Ωστόσο, μια σειρά από μελέτες έχουν αναδείξει την ύπαρξη γραμμικής σχέσης ανάμεσα στις δύο αυτές διαστάσεις και επομένως με την προώθηση της ισότητας, μπορεί να επιτευχθεί και η προώθηση της ποιότητας. Παρ 'όλα αυτά, υπάρχει ένα κενό στον χώρο της εκπαιδευτικής αποτελεσματικότητας και της σχολικής βελτίωσης ως προς το ποιοι είναι οι παράγοντες αυτοί που μπορούν να

προωθήσουν όχι μόνο την ποιότητα στην εκπαίδευση, αλλά και την ισότητα. Αξίζει να σημειωθεί ότι η διάσταση της ισότητας εξετάζεται στη βιβλιογραφία με δύο τρόπους: ισότητα που συνδέεται με τη δικαιοσύνη (fairness) και ισότητα που συνδέεται με την ένταξη (inclusion). Στην παρούσα έρευνα, η διάσταση της ισότητας συνδέεται με τη δικαιοσύνη, υποδηλώνοντας ότι το υπόβαθρο ενός μαθητή (π.χ. το ΚΟΕ, φύλο και εθνικότητα) δεν πρέπει να αποτελούν εμπόδιο στα μαθησιακά του επιτεύγματα.

Σε αυτό το πλαίσιο, η έρευνα που παρουσιάζεται σε αυτή τη διδακτορική διατριβή έχει ως στόχο να υποστηρίξει δημοτικά σχολεία τεσσάρων Ευρωπαϊκών χωρών (Κύπρο, Αγγλία, Ελλάδα και Ιρλανδία) που βρίσκονται σε κοινωνικά μειονεκτούσες περιοχές, να χρησιμοποιήσουν μια δυναμική προσέγγιση η οποία έχει τεκμηριωθεί τόσο θεωρητικά όσο και εμπειρικά, για να ενισχύσουν τις βασικές Μαθηματικές δεξιότητες των μαθητών τους. Αυτή η προσέγγιση (δηλ., η Δυναμική Προσέγγιση Βελτίωσης της Σχολικής Αποτελεσματικότητας) βασίζεται στο Δυναμικό Μοντέλο Εκπαιδευτικής Αποτελεσματικότητας που έχει τεκμηριωθεί εμπειρικά μέσα από πληθώρα διεθνών ερευνών. Το δυναμικό μοντέλο εφιστά την προσοχή στις ενέργειες που πρέπει να αναληφθούν προκειμένου να βελτιωθεί η σχολική πολιτική για τον τρόπο διδασκαλίας, η σχολική πολιτική για τη δημιουργία ενός υποστηρικτικού περιβάλλοντος μάθησης και η αξιολόγηση του σχολείου (παράγοντες αποτελεσματικότητας που εδράζονται στο επίπεδο του σχολείου του δυναμικού μοντέλου) για την προώθηση τόσο της διάστασης της ποιότητας όσο και της ισότητας. Συγκεκριμένα, τα σχολεία αυτά υποστηρίχθηκαν για την ανάπτυξη δράσεων και στρατηγικών στη βάση της δυναμικής προσέγγισης και λαμβάνοντας υπόψη το συγκείμενό τους, ώστε να βοηθήσουν τους μαθητές τους να βελτιώσουν τα μαθησιακά τους αποτελέσματα στα Μαθηματικά (διάσταση της ποιότητας) και επίσης να μειώσουν την επίδραση του κοινωνικοοικονομικού υπόβαθρου των μαθητών τους στα μαθησιακά τους αποτελέσματα (διάσταση της ισότητας). Για να επιτευχθεί αυτό, τα δημοτικά σχολεία με υψηλό ποσοστό μαθητών με χαμηλό ΚΟΕ στις τέσσερις χώρες κλήθηκαν να συμμετάσχουν στην παρούσα έρευνα. Από τις τέσσερις χώρες, 72 δημοτικά σχολεία συμφώνησαν να συμμετάσχουν και ακολούθως αυτά χωρίστηκαν τυχαία στην πειραματική ομάδα (n=36) και ομάδα ελέγχου (n=36). Στην αρχή και στο τέλος του σχολικού έτους 2015-16, συλλέχθηκαν δεδομένα για την επίδοση των μαθητών στα Μαθηματικά μέσω γραπτών δοκιμίων σε όλους τους μαθητές των Δ΄, Ε΄ και Στ΄ τάξεων (n=5560), καθώς επίσης και για τη λειτουργία των παραγόντων εκπαιδευτικής αποτελεσματικότητας στο επίπεδο του σχολείου μέσω ενός ερωτηματολογίου προς όλους τους εκπαιδευτικούς του δείγματος (n=762). Στο τέλος της σχολικής χρονιάς, χορηγήθηκε επίσης ένα ερωτηματολόγιο προς τους μαθητές για τη μέτρηση του ΚΟΕ τους. Τα σχολεία

της πειραματικής ομάδας εφάρμοσαν τη δυναμική προσέγγιση, ενώ τα σχολεία της ομάδας ελέγχου υποστηρίχθηκαν για να αναπτύξουν τις δικές τους στρατηγικές και σχέδια δράσης, αλλά χωρίς να χρησιμοποιήσουν τη δυναμική προσέγγιση. Απαραμετρικά στατιστικά κριτήρια χρησιμοποιήθηκαν για να προσδιοριστεί οποιαδήποτε στατιστικά σημαντική πρόοδος σε σχέση με την απόδοση της κάθε ομάδας σχολείων στους τρεις κυριάρχους παράγοντες στο επίπεδο του σχολείου. Σε κάθε χώρα, διαπιστώθηκε ότι μόνο τα σχολεία της πειραματικής ομάδας κατάφεραν να βελτιώσουν τη λειτουργία αυτών των σχολικών παραγόντων σε στατιστικά σημαντικό επίπεδο. Επιπλέον, διενεργήθηκαν στατιστικές αναλύσεις με τη χρήση πολυεπίπεδων μοντέλων ανάλυσης δεδομένων για κάθε χώρα ξεχωριστά για την αξιολόγηση της επίδρασης της δυναμικής προσέγγισης στη βελτίωση της επίδοσης των μαθητών και την αναζήτηση συνδυαστικών επιδράσεων (interaction effects) της χρήσης της δυναμικής προσέγγισης και των παραγόντων του υπόβαθρου των μαθητών στα τελικά μαθησιακά αποτελέσματα. Σε κάθε χώρα, τα σχολεία της πειραματικής ομάδας πέτυχαν καλύτερα αποτελέσματα στα Μαθηματικά από την ομάδα ελέγχου στο τέλος της σχολικής χρονιάς. Στην αρχή της σχολικής χρονιάς, οι διαφορές στις επιδόσεις των μαθητών που οφείλονταν στο ΚΟΕ ήταν εξίσου μεγάλες και στις δύο ομάδες. Στο τέλος της παρέμβασης, οι μαθησιακές διαφορές μεταξύ των μαθητών που οφείλονταν στο ΚΟΕ μειώθηκαν μόνο στην πειραματική ομάδα. Εντούτοις, η δυναμική προσέγγιση δεν φάνηκε να έχει επίδραση στη διάσταση της ισότητας όταν η διάσταση αυτή εξετάστηκε ως προς τις μαθησιακές διαφορές που οφείλονταν στο φύλο και στην εθνικότητα. Εισηγήσεις για περαιτέρω έρευνα και για σκοπούς χάραξης εκπαιδευτικής πολιτικής, όπως και για διαμόρφωση αποτελεσματικών πρακτικών με βάση τα αποτελέσματα του προγράμματος, αναφέρονται στο τελευταίο κεφάλαιο της παρούσας διατριβής.

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Four European countries (Cyprus, England, Greece, and Ireland) participated in this project therefore, the contribution of the European partners is acknowledged. School selection, questionnaires and tests administration as well as data entering in England, Greece and Ireland were conducted by members of the corresponding national teams. School selection, questionnaires and tests administration as well as data entering in Cyprus were conducted by the author of the present doctoral dissertation (Evi Charalambous). Data processing (i.e., cleaning and recoding as well as merging all data to create a common database) was performed by the author. All statistical analyses presented in this doctoral dissertation were performed by the author. More information regarding the explicit role of the author (Evi Charalambous) in the project, is provided in Appendix G.

DEDICATION

This doctoral dissertation is dedicated to my parents Emilios and Evdokia, my husband Nikolas and my precious daughter Chrysovalanto. Thank you for your love, support and patience.

I would also like to express my deepest gratitude to my supervisor, Professor Leonidas Kyriakides, for providing guidance, encouragement, and feedback throughout my doctoral study.

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Chapter 1: Introduction

In this chapter a broad view of the study is presented. First, quality and equity dimensions of Educational Effectiveness Research (EER) are briefly introduced and then the contribution of EER in promoting school effectiveness in terms of both dimensions is identified. Second, the purpose of the study and its precise research questions are specified. Third, recognition of the theoretical contribution of the study and its significance for policy and practice is given. At last, an outline of the thesis is presented to enable readers understand the contents of the present study.

Quality and Equity: The Two Dimensions of Educational Effectiveness

Schools in every country are places where mainly learning takes place and therefore the goals of education should be, above all the others aims, student learning outcomes. Consequently, researchers in the field of EER were trying to identify factors associated with student achievement and to explain how and why these factors have an impact on the effectiveness status of schools (Scheerens & Bosker, 1997; Teddlie & Reynolds, 2000). But since students of any age and culture differ from each other in a variety of cognitive and psychomotor skills, generalized and specialized prior knowledge, interests, incentives, personal learning style and socioeconomic background (Tomlinson, 2014), EER could not only focus on identifying factors that promote higher educational gains in different domains of learning (cognitive, affective and psychomotor) and subject areas (*quality dimension of effectiveness*).

The research concerned with the influence of schools on different groups of students, named differential effectiveness research, points out that those who have high results in achieving educational objectives in general do this for specific groups, but they cannot significantly reduce the variance between students learning outcomes (Campbell et al., 2004; Teddlie & Reynolds, 2000). Research into educational effectiveness reveals that in some countries teachers and schools matter most for the initially low-achieving students (Kyriakides, 2004, 2007) and therefore it is also possible to look at the effectiveness of a school from a different point of view, especially through investigating how they can reduce unjustifiable differences in outcomes of schooling (Sammons, 2010). This results in educational objectives and criteria for educational effectiveness which are not related to a specific objective and specific students, but related to different groups of students in relation to each other. Many studies in the field of EER show that students' final learning outcomes depend on their initial performance and their initial performance depends on

their socioeconomic status (SES) (Scheerens & Bosker, 1997; Teddlie & Reynolds, 2000; Townsend, 2007). Thus, there is a need to search for the contribution of the school to restrain these differences among students. In this way, it could be examined if education can contribute to social justice and democracy by closing the achievement gap between students with regard to their socioeconomic background (*equity dimension*) (Chapman et al., 2012; Kelly, 2012; Lafontaine et al., 2015; Sammons, 2007, 2010; Sammons et al., 2018). Therefore, both dimensions in measuring educational effectiveness – *quality and equity* – should be taken into account when establishing theoretical models of educational effectiveness.

Explicit definitions of the concepts of quality and equity should be provided in order to clarify what schools can do in order to promote both dimensions and therefore in Chapter 2 the terms quality and equity are addressed in detail. It should be taken into account that the concept of equity is subject to several interpretations (Demeuse et al., 2001; OECD, 2004). Philosophers have been struggling for a long time to clarify what might be meant in social policy by the term equity. However, there is a general agreement that the aim of public policy cannot and should not be equity in the sense that everyone is the same or achieves the same outcomes, a statement that appears to be both impossible and undesirable (see Levin, 2003; OECD, 2004). It is therefore important for this study to examine the different ways equity is understood and measured and examine its relation with quality (see Chapter 2).

The Contribution of Educational Effectiveness Research in Promoting School Effectiveness in Terms of Quality and Equity

During the 1970s, the first effectiveness studies (Edmonds, 1979; Rutter et al., 1979) were concerned with examining evidence and making an argument about the potential power of schooling to make a difference to students' life chances. After the publication of those studies, several studies in different countries followed during the last three decades, for enhancing school effectiveness and school improvement efforts and aiming at putting the results of research into practice (Teddlie & Reynolds, 2000; Townsend, 2007). One of the main aims of these effectiveness studies was to support teachers and schools in their attempt to provide equal opportunities to their students with different learning needs arising from their background and personal characteristics.

However, most effectiveness studies, while examining the extent of teacher and school effects, have paid very little attention to the extent to which teachers and schools perform consistently across different school groupings (Kyriakides, 2007). As a

consequence, the concepts of teacher and school effectiveness have been developed in a generic way and have not been able to contribute significantly to the improvement of education for different groups of students (Creemers & Kyriakides, 2006). As a result, critics of EER argue that there are really no grounds for thinking that EER can overcome the effects of social disparity. Although greater effectiveness may somehow improve the absolute performance of disadvantaged groups, critics argue it will not improve their relative performance against more advantaged groups (Thrupp, 2001). A lot of criticism has also been earlier developed against this kind of school improvement and research, almost a decade after the first effectiveness studies with its conspicuous sampling prejudices (Firestone & Herriot, 1982; Good & Brophy, 1986; Purkey & Smith, 1983; Ralph & Fennessey, 1983; Rowan et al., 1983). Consequently, EER is currently more realistic in its beliefs about the contributions that educational effectiveness can have in promoting equity. Based on the knowledge base about quality education, effective schools are able to promote the learning of their students but may not have a special impact on disadvantaged students (Kyriakides, 2004). Therefore, research into differential teacher and school effectiveness (e.g., Kyriakides, 2004; Strand, 2010) may provide a new perspective in the discussion about educational equity, and answers could be provided to the critics of EER who argue that EER has not given consideration to equity and justice. Research into differential effectiveness could raise issues regarding the development and implementation of policy on educational equity. If schools differ significantly in terms of their effectiveness for particular pupil groups, issues concerning the extent to which specific factors are associated with school effectiveness in promoting the progress of specific groups of pupils can be examined (Kyriakides, 2007). By identifying these factors, policymakers could attempt designing and implementing policies on equal opportunities.

Taking all the above into account, the *dynamic model of educational effectiveness* (Creemers & Kyriakides, 2008) has been developed, attempting to demonstrate the complexity of improving educational effectiveness by using the major findings of research on differential teacher and school effectiveness (e.g., Campbell et al., 2004; Kyriakides, 2004; Strand, 2010) in structuring its framework. The dynamic model is based on the assumption that both the quality and the equity dimensions of educational effectiveness should be considered in establishing criteria for measuring effectiveness and in building theoretical models of educational effectiveness (Kyriakides et al., 2021). In particular, results of a study conducted by Kyriakides and Creemers (2011), showed that effective schools as to the equity dimension were equally effective as to the quality dimension and none of the schools has failed to improve its effectiveness in relation to the one dimension

and reduce its effectiveness in relation to the other dimension. Hence, promoting one of the two dimensions does not mean that this could negatively affect the other one, but rather the opposite since the relationship between them appears to be linear.

Nevertheless, none of the studies in the field of EER conducted until this time tries to identify factors that could explain differences in the effectiveness of teachers and schools in relation to the equity dimension. Therefore, this study aims to build on the dynamic model to examine how factors included at the school level may determine differences in the effectiveness of schools in relation not only to the quality dimension but also to the equity dimension. To manage this, the proposed research makes use of the *Dynamic Approach to School Improvement (DASI)* (see Creemers & Kyriakides, 2012). Since the dynamic model was developed in order to establish stronger links between EER and improvement of practice, DASI has been introduced in order to help schools and teachers find out *why* specific factors are associated with students learning outcomes and consequently *how* they can improve their effectiveness (Creemers & Kyriakides, 2010a). DASI emphasises the importance of collecting data about the functioning of school level factors to identify school improvement needs. In this way, an *evidence-based* and *theory-driven approach* to improvement is gradually developed. The theoretical framework and main steps of this approach are presented in Chapter 2 and are used to design an experimental study aiming to help schools improve their effectiveness in terms of both quality and equity (Chapter 3).

Rationale of the Study

The economic crisis of the last years has posed even bigger encounters to equity since more families are now economically exposed and have difficulties in meeting the costs of education. In a more competitive labour market, skills and knowledge are also more important than ever. School failure as identified in the results of the Trends in International Mathematics and Science Study (TIMSS) and Programme for International Student Assessment (PISA), uncovers the need for actively supporting equity in education since evidence shows that the relations between disadvantaged schools and low performance are strong.

Specifically, there is a positive relationship between schools with fewer students from economically disadvantaged homes and higher Mathematics achievement, with almost a 50-point gap (Mullis et al., 2008; OECD, 2010a), whereas disadvantaged schools seem to perform less well than the national average performance (OECD, 2016a). In addition, research evidence shows that students with socially disadvantaged backgrounds

are more likely to have lower school results and to drop out of school more frequently than children coming from better-off families (Kyriakides, Creemers, & Charalambous, 2018; Sirin, 2005). Also, around 19% of 15-year-old students scored below Level 2 in Reading on the 2009 PISA test, which indicates that almost one out of five young people across OECD countries have not acquired the basic literacy skills, and in some countries this proportion even exceeded 25% (OECD, 2012). Moreover, 23% of students in OECD countries, and 32% of students in all countries participating in PISA 2012, did not reach the baseline Level 2 in the PISA Mathematics assessment (Schleicher, 2014). These percentages of students are more likely to either drop out from school early and enter the labour market with low skills or continue studying but facing learning difficulties and needing additional support (OECD, 2012). PISA also reports that 40% of the variation in student performance in mathematics is found between schools within a country (OECD, 2012).

Thus, educational policies should invest in providing greater educational opportunities in the early years of schooling and support equitable practices that could help socially disadvantaged students acquire the basic knowledge and skills in every learning subject. School- based interventions aiming to improve the quality and equity of education are needed and a synthesis of various effectiveness programs aiming to improve the attainment of primary students with low basic skills reveals that *whole school* interventions are more effective in this regard (Borman et al., 2003; Creemers & Kyriakides, 2012; Hattie, 2009; Scheerens, 2013).

Purpose of the Study and Research Questions

Taking all the above into consideration, this study purposes to investigate the use of an evidence-based and theory-driven approach (i.e. the DASI) in primary schools from four European countries (Cyprus, England, Greece, and Ireland) to help students achieve basic skills in Mathematics. This approach draws on the dynamic model of educational effectiveness which provides a dynamic perspective on the functioning and effects of education and refers to factors operating at different levels (i.e., student, classroom, school and context) that need to be addressed to promote quality and equity in education. Specifically, schools in socially disadvantaged areas within the four countries (which are more likely to have children with low basic skills) were encouraged to develop their own strategies and actions by using DASI (Creemers & Kyriakides, 2012) and adapting it to the specific context and problems they face. In this way they are expected to help their students improve their learning outcomes in Mathematics (quality dimension) and also

reduce the impact of their students' background characteristics on their learning outcomes (equity dimension).

The effect of DASI on promoting quality has been revealed through national and international experimental studies (see Creemers & Kyriakides 2015; Kyriakides et al., 2021). However, the impact of DASI on promoting equity has not been systematically examined. In this thesis, the use of a methodology based on a design which allows the impact of an intervention to be examined in terms of promoting both quality and equity is demonstrated and put in practice.

This study is based on the assumption that education can contribute to social justice and democracy by closing the gap in learning outcomes among all students, regardless of their social background. Consequently, through implementing DASI in socially disadvantaged schools in four European countries, this study provides answers to the following three research questions:

1. Have the participating schools managed to improve the functioning of their school policy for teaching, policy for creating the school learning environment (SLE), and school evaluation (overarching school factors of the dynamic model) while implementing DASI?

2. What is the impact of DASI on promoting student achievement in Mathematics?

3. What is the impact of DASI on reducing the effect of the socioeconomic background of the students on their Mathematics learning outcomes?

Theoretical Contribution of the Study

First, this study contributes to the discussion about the relation between quality and equity. The different theoretical positions with respect to the debate on promoting equity and its impact on quality are analysed and it is explained that this can partly be attributed to the fact that the equity dimension was rarely explicitly defined and consequently there is not enough evidence investigating the relation between the two dimensions of effectiveness in classroom, schools and educational systems. Thus, the two dimensions of effectiveness are put together to investigate if a school improvement approach found to be effective in promoting quality can also promote equity.

Second, during the last three decades, various large scale effectiveness studies were conducted in several countries demonstrating the impact that teachers and schools can have in promoting student learning outcomes (Muijs et al., 2014; Reynolds et al., 2014). Almost

all studies in the field of EER measure school effectiveness in relation to the quality dimension (Sammons, 2010). In regard to the impact of schools on equity, some studies revealed that teachers and schools matter most for underprivileged and/or initially low-achieving students (e.g., Kyriakides, 2004, 2007; Scheerens & Bosker, 1997). However, none of these studies was looking at the extent to which effectiveness factors can explain variation in teacher and school contribution towards the reduction of gaps among students of different socioeconomic groups (equity dimension). Therefore, studies as the present one promoting also the equity dimension are essential for expanding and enhancing the area of educational effectiveness.

Third, more than 20 empirical studies (national and international) and two meta-analyses undertaken during the last 15 years (for a review of these studies see Kyriakides et al., 2021) provided support to the validity of the dynamic model upon which this study is based. Based on the results of these studies, an evidence-based and theory-driven approach to school improvement has been developed (Creemers & Kyriakides, 2012). This approach (i.e. DASI) has been used in four experimental studies and revealed that it had a strong impact on improving learning outcomes (Antoniou & Kyriakides, 2011; Christoforidou et al., 2014; Demetriou & Kyriakides, 2012; Kyriakides et al., 2014). Although these four studies provide some empirical support on the impact that DASI can have on promoting student learning outcomes (quality), participating schools were not situated in socially disadvantaged areas. Hence, in this study, it is investigated whether DASI can be used by schools in socially disadvantaged areas to promote both quality and equity. Therefore, it is examined whether school stakeholders and the Advisory and Research Team (A&RTeam) are facing special challenges in implementing this approach to this group of schools. The study's results may help to further develop DASI and identify factors important for promoting quality in this group of schools and/or factors important for promoting equity.

Significance of the Study

First of all, researchers in the field of EER have reached the conclusion that schools may have a role in bridging the achievement gap between students coming from different socioeconomic backgrounds and that specific school policies, organisational and contextual factors, might foresee schools' ability to do so (Chudgar & Luschei, 2009; Huang & Sebastian, 2015; OECD, 2013a). Hence, studies measuring school effectiveness in relation to both quality and equity dimensions may help evaluating policy reforms aiming to promote equity. For example, policies on promoting adapting teaching or on

providing extra resources to schools in difficult circumstances can be evaluated by investigating their impact on promoting equity at the school level.

Secondly, by identifying factors associated with both the quality and the equity dimensions of school effectiveness, this study may contribute towards the development and dissemination of research-based school improvement designs by policy makers that promote effectiveness in terms of both dimensions (e.g., Datnow & Stringfield, 2000; Jordan et al., 2000; Slavin & Madden, 2000). Also, the results of this study may help in the development of specific strategies that can be used by different stakeholders who are planning to make use of the dynamic theory to improve quality and equity in education. Moreover, since this study took place in four European countries, implications for the development of national policies for promoting quality and equity in these specific countries can be drawn. Additionally, awareness on other countries (to policy makers, practitioners and researchers) can be raised since international evaluation studies reveal that countries all over the world face a serious challenge to promote not only quality but also equity in education. DASI may help policy makers to realise the importance of using theory-driven and evidence-based approaches to school improvement, as they have the best potential for making a significant influence to the improvement of student learning outcomes and the reduction of differences in learning outcomes attributed to socioeconomic and background characteristics (Slavin & Fashola, 1998).

Thirdly, the findings of the study may also support the view that improvement efforts should be based at the school level and thereby school factors and their dimensions associated with quality and equity should be addressed by each school's stakeholders to improve their effectiveness.

Fourthly, this research takes place in four European countries (Cyprus, England, Greece, and Ireland) with similar characteristics. PISA reports that almost 40% of the variation in student performance in mathematics is found between schools within these countries and reveals that nearly 14% of the variance in student achievement is explained by the socioeconomic background of the students in the aforesaid countries (see OECD, 2010b; OECD, 2012). Thus, the promotion of equity is considered a priority in each one of these countries. Additionally, three out of the four countries (Cyprus, Greece, and Ireland) were affected by the economic crisis of the last years and all of them have a mean performance in Mathematics not statistically significant different from the OECD average (Ireland and England) or below the OECD average (Cyprus and Greece) (OECD, 2014). Moreover, there is a variation between these four countries regarding the way that educational policy is applied to schools in order to support students coming from low

socioeconomic backgrounds. For example, Ireland has a specific policy that focuses on providing special support and learning opportunities to these students whereas Cyprus and Greece have no clear policy on promoting equity in education. Consequently, this study can raise awareness among policy-makers and practitioners of these countries and might help them to focus on factors that can promote both quality and equity in education. It should also be acknowledged at this point that the dynamic model of educational effectiveness (see Creemers & Kyriakides, 2008), which is the theoretical framework upon which the intervention of the present study is based, has been empirically tested in these four countries through several international and national studies (e.g., Christoforidou & Xirafidou, 2014; Kyriakides, Creemers et al., 2015; Panayiotou, Kyriakides, & Creemers, 2016; Panayiotou et al., 2014). In addition, a number of experimental studies have been conducted in three out of the four participating countries (i.e., Cyprus, England and Greece) in order to identify the impact of DASI on promoting student learning outcomes (e.g. Kyriakides et al., 2014). However, schools participating in the experimental studies investigating the impact of DASI on promoting quality in education were not situated in socially disadvantaged areas. Therefore, in this study it is investigated whether DASI can help schools in these areas as well to become more effective.

Fifthly, the role of school self-evaluation is emphasized since this is an essential part of DASI. School self-evaluation data can help schools identify their priorities for improvement in order to develop strategies and action plans that take into account the knowledge-base of EER with the support of the research team (Creemers & Kyriakides, 2012; Schildkamp et al., 2012). Additionally, the role of formative evaluation is stressed since it helps schools to continuously adapt their action plans to the skills and needs of students, teachers, parents and other school stakeholders. In this way, school evaluation data can be used not only for summative but mainly for formative reasons in order to raise awareness of school management teams and other school stakeholders about the importance of promoting equity along with quality.

Sixthly, the teachers of the participating schools who identified effective and differential approaches and actions to promote quality and equity are expected to develop their professional skills. School management teams (e.g., head teachers, deputy heads) are as well anticipated to benefit, since they developed an improvement plan, implemented, and evaluated it by using school self-evaluation approaches. In this way, not only their effectiveness in promoting student learning outcomes in mathematics can be improved, but also their skills in educational management could be developed.

Finally, special attention is given to students coming from low socioeconomic backgrounds, who might receive fewer learning opportunities at home and face difficulties meeting the aims of the school curricula. By supporting their teachers and the school management team to take actions to promote quality and equity, their basic skills in Mathematics are expected to be increased. Other students who are at risk of dropping out of school can be as well benefitted from this study, since this study increases the awareness of teachers and schools on how to differentiate instruction and meet the needs of this group of students (Tomlinson, 2014). Parents of these groups of students are also expected to be indirectly influenced since the theoretical framework of this study (DASI), is concerned with the development of partnership policy and parental involvement in order to promote quality and equity. DASI encourages differentiation on the functioning of school policy factors to help the school management team to respond to the special needs of this group of parents who are facing difficulties in being actively involved in their children's schools (Devine, 2013).

Outline of the Thesis

The first chapter of this thesis is an introduction to the theoretical background of the study by presenting the two dimensions of educational effectiveness, quality and equity. The contribution of EER in promoting school effectiveness in terms of both dimensions is then highlighted and the research aims of the study are defined. At the end of Chapter 1, the contribution of the study to theory, policy and practice is underlined. Chapter 2 provides a literature review of the background and history of EER. The impact of the socioeconomic background factors on student achievement is also explored through studies conducted in the field of EER. Definitions of the quality and equity dimensions are provided and the relation between the two dimensions is identified as well, based on research findings. Moreover, the dynamic model of educational effectiveness is presented as the theoretical framework of the study. Specifically, the rationale and validity of the model are outlined and the impact of student and school level factors of the model on student achievement is discussed. Additionally, the Dynamic Approach to School Improvement (DASI) that has been developed using the dynamic model as its theoretical framework is presented followed by its main assumptions, steps and studies conducted to investigate its impact on promoting quality in education. Chapter 3 describes the methodology of the study. It is first of all explained why the experimental research method has been chosen and then the participants and the main variables of the study are set. A detailed description of the intervention stages and procedures is furthermore provided, followed by the analysis of

data and the statistical techniques used to measure the impact of DASI on promoting quality and equity in the participating schools. At the end of Chapter 3, the main methodological limitations of the study are acknowledged. Chapter 4 presents the results deriving from the analysis of the data from the participating schools in the four countries, showing the impact of the intervention (i.e. DASI) on improving the school level factors, on improving students' learning outcomes in Mathematics and on reducing the impact of the socioeconomic background characteristics of students on their learning outcomes. To end with, in Chapter 5 the main results of the study are discussed in detail, implications for theory, policy and practice are drawn and suggestions for further research are made.

Chapter 2: Literature Review

Chapter 2 provides first of all a thorough historical literature review in the field of EER to help readers understand the basic components of the field as regards to "*what works*" in education and "*why*". Then, the impact of socioeconomic background factors on student achievement is identified to be able to understand the importance of promoting both quality and equity dimensions. Additionally, in the third part of this chapter, detailed definitions and measurement ways of both dimensions are provided. Moreover, research evidence on the relation between quality and equity is presented to highlight and support the intentions of carrying out the present study. In the fourth part of this chapter, the theoretical framework (i.e. the dynamic model of educational effectiveness) of the study is presented by giving emphasis to the impact of its student and school level factors of student achievement. In the last part of the chapter, the rationale and basic steps of the approach used in the study (i.e. the DASI) are explicitly described and, lastly, the studies conducted so far to investigate the impact of this dynamic approach on promoting quality are mentioned.

Background and Historical Review on Educational Effectiveness Research

EER deals with the fundamental research question of which factors situated at different levels of education (e.g. country/system, school, classroom/teacher, and student) can directly and/or indirectly explain the variances in students' outcomes by simultaneously taking into account the background characteristics of the students (e.g., gender, SES, prior achievement, ethnicity).

The field of EER has been developed as a reaction to the research on equity of opportunity in education that was conducted in the USA and undertaken by Coleman et al. (1966), and Jencks et al. (1972). These two studies from the sociological and psychological backgrounds respectively, have reached similar conclusions in relation to the amount of variance in student learning outcomes that can be explained by educational factors. Although these studies did not suggest schooling was unimportant, the differences in student outcomes that were attributable to attending one school rather than another were modest. However, these studies were criticized for failing to measure the educational variables that were of the most relevance (Madaus et al., 1979). Also, these two studies both claimed that after taking into consideration the influence of student background characteristics such as SES, gender, ethnicity, not much variance in student achievement was left to be explained. Subsequently, these results lead to the conclusion that schooling

could not contribute to reducing inequality in educational outcomes and in society as a whole. Similarly, the failure of large-scale educational compensatory programs, such as the "Head Start" and the "Follow Through" conducted in the USA and of other programs in other countries (Driessen & Mulder, 1999; MacDonald, 1991; Sammons et al., 2003; Schon, 1971; Taggart & Sammons, 1999) which were based on the idea that education in pre-schools would help reimburse for initial differences between students, provided support to the argument that a strong relation exists between all kinds of academic achievement variables and what has come to be known as SES. As a consequence, measures of SES have been used in an excessive way by education researchers in different ways, ranging from designing interventions (e.g., used as covariates to control for bias especially in quasi-experimental studies), to searching for differential effects of interventions (e.g., examining whether method A is more effective with low-SES students whereas method B is more effective with high-SES students), to trying to establish the validity of causal models (e.g., SES is used as one of the causal agent for predicting student learning outcomes).

As a reaction to the research findings above, two effectiveness studies carried on independently, Brookover et al. (1979) in the U.S.A. and Rutter et al. (1979) in the United Kingdom, were concerned with finding out if school matters to students' life chances. The results of these studies revealed that teachers and schools differ among themselves in performance, but the question that remained unanswered was how much they differ. However, in EER, the main issue is not only to find out ***what*** is more effective but ***why*** it is more effective. This means that, in the following years, EER began the examination of theories which can explain why some schools and teachers are more effective than others. Consequently, reviews by Teddlie and Reynolds (2000), Scheerens and Bosker (1997), and Levine and Lezotte (1990) found many factors/variables for effective classrooms, schools, educational systems which highlight a more theoretical foundation of EER, including a combination of the factors into categories. This means that sets of variables in all four levels (i.e. student, teacher/classroom, school and system) are described as effectiveness factors by different researchers. For example, Edmonds' "five-factor model" (1979) was one of the first effectiveness models that placed special emphasis on variables such as leadership, high expectations, basic skills, climate and frequent evaluation of students' progress. Later on, more advanced models of school effectiveness were developed (e.g., Clauset & Gaynor, 1982; Duckworth, 1983; Stringfield & Slavin, 1992) stressing the fact that various levels in education contribute to student performance. Nevertheless, the question about the reason why certain characteristics correlate positively with achievement

remained unanswered. For that reason, several theoretical orientations were used to explain why certain characteristics might contribute to educational effectiveness.

Three theoretical orientations/perspectives within the field of EER attempted to explain why and how specific variables contribute to educational effectiveness: *(a) the economical perspective*, *(b) the sociological perspective*, and *(c) the psychological perspective*.

First, *economists* have focused on variables concerned with resource inputs, such as per student expenditure, to explain variation in the effectiveness status of teachers and schools. Specifically, the economic approach is focused on producing a "function" which exposes the relationship between the "supply of selected purchased schooling inputs and educational outcomes controlling for the influence of various background features" (Monk, 1992, p. 308). Thus, the emerging "education production" models (e.g., Brown & Saks, 1986; Elberts & Stone, 1988) were based on the hypothesis that increased inputs will lead to increments in outcomes. It is also very important to note that, for the economic analysis of effectiveness, the value of inputs and outputs are expressed in terms of money. This means that unless input costs like teaching materials and teacher's salaries are known, school effectiveness cannot be determined. On the other hand, research studies (e.g., Hanushek, 1989; Hedges et al., 1994) showed that reducing the student/teacher ratio and/or increasing the amount of funding of education per student does not necessarily result in higher student outcomes. Therefore, the economic perspective of EER has so far not helped to clearly understand what measures are necessary to achieve maximum outputs.

Second, the *sociological perspective* of EER addresses three issues. First, input factors concerned with the educational background of students, such as SES, gender, social, and cultural factors, are examined in the attempt to identify the effect of these factors on student achievement gains, as well as the ability of education to compensate for these differences by adapting education to the needs of different groups of students. Second, related to this, the sociological perspective contributed to the discussion about the criteria of measuring effectiveness. Through their emphasis on the importance of reducing the variance in student outcomes compared to their prior achievement educational gap, two dimensions of measuring educational effectiveness concerning both quality and equity emerged. In this respect, studies on the effect of contextual factors (Opdenakker & Van Damme, 2006) and on the extent to which teachers and schools are equally effective with different groups of students (i.e., differential educational effectiveness) have been conducted (e.g., Campbell et al., 2004; Kyriakides, 2004). Third, process variables associated with sociological theories of organisation (e.g., school climate, culture, and

structure) were treated as school level factors associated with student achievement. However, the structure of procedures (particularly school management) and the culture have received the most emphasis in the practice of empirical effectiveness research, but the empirical basis for the importance of these factors still needs to be strengthened (Freiberg, 1999; Maslowski, 2001).

Last, *educational psychologists* focused on student background factors such as "learning aptitude" and "motivation," and on variables measuring the learning processes which take place in classrooms by taking into consideration Gage's theory (1963). In research on teaching, there was gradually less interest in teacher behaviour and the effect of teacher and instructional behaviour, and more interest in teacher cognition and teacher thinking. Within EER, initially attention was directed to the effects of schools; however, after the introduction of methods for multilevel analysis and a more theoretical orientation within EER, more emphasis was put on the learning and instructional level (Teddlie & Reynolds, 2000). A famous model within EER was Carroll's model for learning in schools (Carroll, 1963), because it related individual student characteristics important for learning to characteristics of education important for instruction. In addition, Carroll indicated the factors of time and the quantity and quality of instruction as important concepts for learning in schools.

Later on in the 1990's, researchers attempted to incorporate the findings of research on the three perspectives of EER and to develop theoretical models which have a multilevel structure (e.g., Creemers, 1994; Scheerens, 1992; Stringfield & Slavin, 1992). Specifically, the comprehensive model of educational effectiveness (Creemers, 1994) is considered to be as one of the most influential theoretical constructs in the field (Teddlie & Reynolds, 2000) since emphasis is given to the impact of schools and teachers on learning outcomes and the multilevel nature of the factors affecting student achievement is taken into account. Thus, Creemers' model is considered as the starting point for the development of the dynamic model of educational effectiveness 14 years later (Creemers & Kyriakides, 2008). Although these models made use of organisational theories and theories of learning and refer to multiple factors at different levels, each of them is either focused on the classroom or the school level. Depending on this, more emphasis is given either to theories of learning or to organisational theories.

Six studies examined the validity of the comprehensive model and provided some empirical support to the model (Kyriakides, 2008). These studies also revealed that the relationship between factors at different levels might be more complex than assumed in the integrated models. This is especially true for interaction effects among factors operating at

classroom and student level which reveal the importance of investigating differential effectiveness. These studies have also revealed suggestions for further development of the model especially by taking into account the dynamic nature of educational effectiveness. Since teaching and learning are dynamic processes that are constantly adapting to changing needs and opportunities, effective schooling should be treated as a dynamic, ongoing process. Consequently, the new models of EER should take into account the new goals of education as well as the new theories of teaching and learning in order to specify variables associated with the quality of teaching. A model also needs to explain previous empirical research parsimoniously and map a series of avenues for future research, which may help expand the knowledge base of school effectiveness. Lastly, a theoretical model should act as a useful guide for practitioners. This is something that has been absent in school improvement research, which usually make use only of the practitioners' knowledge and experiences. The dynamic model of educational effectiveness (Creemers & Kyriakides, 2008) is established in a way that helps policy makers and practitioners to improve educational practice by taking rational decisions concerning the optimal fit of the factors within the model and the current situation in the schools or educational systems. This model is used as the theoretical framework of the present study and therefore detailed description of its rationale and basic elements is given in the fourth part of this chapter.

Looking at the history of EER and its developments identified in this review, one can distinguish four sequential phases. During the first phase of EER studies were conducted to show the importance of having effective teachers and schools, and that school and teacher effects tend to be larger for disadvantaged groups. However, researchers had concentrated on the quality dimension rather than the equity since their interest was to measure the impact of teachers and schools in promoting learning outcomes for all groups of students assuming that teachers and schools who are effective with one group of students are likely to be effective with the others (Kyriakides & Creemers, 2011). In the second phase of EER, the main research question was referred to identifying those factors that help to explain differences in the effectiveness of schools and teachers. The results of studies conducted during the second phase produced lists of variables that were associated with better student achievement and which were treated as key effectiveness factors. However, they did not answer why certain characteristics/factors correlate positively with achievement. Therefore, in the third phase of EER researchers used several theoretical orientations to explain why certain characteristics might contribute to promoting student learning outcomes and the three perspectives within EER described above were developed. Lastly, during the fourth phase, researchers attempted to respond to a major criticism of the

earlier phases of EER that was concerned with the failure of the field to contribute significantly to the establishment of strong links between research on effective factors and developmental work so as to improve the quality of education. In this respect, a dynamic perspective of education is now being taken into account when establishing theoretical models of EER (i.e. the dynamic model of educational effectiveness) and when designing relevant empirical studies.

Taking all the above into consideration, one can realize that gradually the field of EER moved its attention from the contribution of schools in promoting equity (i.e., reducing the gap in achievement attributed to SES) to searching for process variables that are associated with student learning and learning outcomes. Although researchers take into account the student background characteristics in identifying effectiveness factors, a shift in the emphasis of the field to quality than equity can be observed. Since schooling matters in a child's life and equity is measured by investigating the impact that SES has on student achievement, the next part of this chapter is concerned with the effect of this student background factor. Beyond presenting the results of national and international studies investigating the impact of SES on student achievement, the findings of two major meta-analyses in this area are firstly outlined. Researchers could, therefore, establish ways to find out how schools can reduce the effect of the SES on student learning outcomes, which is one of the main aims of this study.

The Impact of Socioeconomic Status on Student Achievement

Looking at the literature on the role of SES one cannot easily find a commonly accepted definition of this important effectiveness factor. White (1982) argues that "even though 'everybody knows' what is meant by SES, a wide variety of variables is used as indicators of SES" (p. 462). It is also claimed that widely accepted definitions of SES are difficult to find. More than 90 years ago, Chapin (1928) defined SES as the "position that an individual or family occupies with reference to the prevailing average of standards of cultural possessions, effective income, material possessions, and participation in group activity in the community" (p. 99). A more formal definition of SES refers to the relative position of a family or individual on a hierarchical social structure, based on their access to, or control over, wealth, prestige, and power (Mueller & Parcel, 1981). It is usually operationalized as a composite measure of income, level of education, and occupational prestige (Dutton & Levine, 1989; Mueller & Parcel, 1981). The community can be any unit in which individuals are clustered, including geographically defined units such as a country, province or state, city or neighbourhood. The community can also be a social or

organizational unit such as a school or workplace. The definition states “individuals” in a community, to emphasize the importance of using individual data to measure the impact of SES on student achievement.

By looking at how SES is measured one can also see that researchers often considered SES to be a function of three major factors: 1) family income; 2) parents' educational level; and 3) parents' occupation. Probably the best known, but not the most frequently used, measures of SES are the *Index of Status Characteristics* (Warner et al., 1949) and Hollingshead's *Two-Factor Index of Social Position* (Hollingshead & Redlich, 1958). The *Index of Status Characteristics* uses information about the family's (a) occupation of principal breadwinner, (b) source of income, (c) quality of housing, and (d) status of residence area, to arrive at a score that is converted to one of the identified social classes (i.e. lower, middle, and upper, with each of these classes further divided into upper and lower). Hollingshead's scale uses indices of occupation and educational attainment to categorize families into one of five social classes (i.e. professional leaders, administrative professions, small employees/skilled labour, semi-skilled workers, unskilled workers).

Even though different SES measures have been used over the years, most cross-national studies agree that family background characteristics have an impact on their child’s learning outcomes. Explicitly, children from high-SES families have better schooling outcomes (Baker et al., 2002; Buchmann & Hannum, 2001; Chiu & Khoo, 2005; Hanushek & Luque, 2003). However, quantitative syntheses of studies investigating the effect of SES on student achievement (e.g., Sirin, 2005; White, 1982) reveal that several studies report either low or moderate correlations of SES with achievement.

Specifically, in the first quantitative synthesis of almost 200 studies, White (1982) focused on the relation between SES and academic achievement. It was found that as typically defined (i.e., taking into account parents’ income, education, and/or occupation status) and typically used (i.e., treated as a student level variable), SES is only weakly correlated with academic achievement. However, when researchers use aggregated measures of SES, they usually report extremely high correlations between SES and academic achievement. This meta-analysis also revealed that different indicators are used to measure SES. This has created an ambiguity in interpreting research findings on the impact of SES on student achievement. Traditional indicators of occupation, education, and income were found to be frequently taken into account in defining SES. Nevertheless, frequent references to factors such as size of family, educational aspirations, ethnicity, mobility, and presence of reading materials in the home were also made. Therefore, although SES has been at the core of a very active field of research, there seems to be an

ongoing disagreement about its conceptual meaning and empirical measurement (Caro et al., 2014) and there is no clear theory on how and why SES influences student achievement (Caro & Lenkeit, 2012; Rothman, 2003). On the one hand, in the literature the impact of SES is attributed to the fact that students coming from a low-SES background are likely to be at a disadvantage in schools because an academic home environment is absent, which influences their academic achievement at school (Sammons et al., 2013; Toth et al., 2020). On the other hand, there are researchers who argue that school and neighbourhood environments influence students' learning outcomes strongly and for this reason socially disadvantaged schools are mostly lower-performing, and only extremely resilient young people can achieve high academic standards (Rothman, 2003). This debate actually reveals the importance of using a theoretical framework to understand how and why SES can influence achievement. It also reveals the importance of treating SES as a measure both at the student and at the school level. Those that support the first scenario treat basically the SES as a student level variable whereas the latter approach gives more emphasis to the use of aggregated measures of SES at the level of school or neighbourhood. It can also be claimed that this debate reveals the importance of searching for interactions between the impact of SES and other process variables at the level of school and system (Kyriakides & Creemers, 2011; Willms, 2003). For example, how governments interpret the SES–achievement debate may influence education policies designed to decrease educational disadvantage.

A second meta-analysis (Sirin, 2005), which was based on American studies conducted from 1990 until 2000, revealed similar findings about the effect of SES on student achievement implying that the SES-gap in educational achievement is not as big as it was assumed in the early 1970s. A slightly smaller effect size of SES on student achievement was even reported in this meta-analysis. This finding was seen as being in line with White's observation that there was a slight trend toward lower correlations between SES and school achievement for the more recent studies in his sample. Regarding the measurement of SES, it was also found that researchers in the 1990s treated SES as a multi-dimensional construct and for this reason different indicators were used to measure it. However, there seems to be an agreement on Duncan et al. (1972) definition of the tripartite nature of SES that incorporates parental income, parental education, and parental occupation as the three main indicators of SES (Gottfried, 1985; Hauser, 1994; Mueller & Parcel, 1981). Many empirical studies examining the relations among these components reported moderate correlations and also found that the components of SES are unique since each one of them measures a substantially different aspect of SES that should be

considered to be separate from the others (Bollen et al., 2001; Hauser & Huang, 1997). Specifically, parental income as an indicator of SES reflects the potential for social and economic resources that are available to the student. The second traditional SES component, parental education, is an indicator of parents' income because income and education in most countries are correlated. The third SES component, occupation, is ranked on the basis of the education and income resulting from a particular occupation (Hauser, 1994). Occupational measures such as Duncan's Socioeconomic Index (Duncan, 1961) produce information about the social and economic status of a household in that they represent information not only about the income and education required for an occupation but also about the prestige and culture of a given socioeconomic stratum. There is even a cultural component in occupations because these are related to different linguistic codes used by the working and the dominant classes (Bernstein, 1971) and their relations with the linguistic codes used in schools. Different explanations used to understand how these three main indicators of SES may influence student achievement are discussed below. Sirin (2005) referred to three other components of SES (i.e., home resources, neighbourhood, and being entitled to free or reduced price meal), but these were not used as often as the three traditional ones mentioned above. This meta-analysis also revealed that the type of SES measure changed the relationship between SES and academic achievement. Specifically, the average correlations between SES and academic achievement was found to range from 0.25 (when SES was operationalized by using neighbourhood characteristics as an indicator of family SES) to 0.47 (when SES was operationalized by using home resources as an indicator of family SES). These two indicators, however, were based on a limited number of studies. More commonly used SES components such as education, occupation, income, and eligibility for school lunch programs produced rather similar results.

Finally, this meta-analysis revealed that the effect of SES was not equally strong for different groups of students. Sirin (2005) pointed out that one of the main findings of his review was that for minorities, SES did not seem to be as strongly related to academic achievement as it was for their White peers. This finding seems to reveal the importance of searching for the SES-gap in student achievement in different contexts and at the same time it reveals a limitation of the two meta-analyses mentioned above which were based on studies conducted in a single country. Sirin (2005) acknowledged this limitation and argued that the weaker correlation of SES found in his meta-analysis may reflect social and overall policy changes over time in USA. For example, the increasing access to learning materials and the availability of compensatory education may have contributed in reducing

the impact of SES on academic achievement from 1970s to 1990s. This implies that the impact of SES on student achievement may not be equally strong in different countries and in different schools.

Researchers have also tried to identify and understand the processes that lie behind the impact that SES has on student achievement. Marks et al. (2006) distinguish four types of explanations based on the extent to which they emphasize the importance of material, cultural, and social factors and school systems. Material resource explanations focus on the roles of poverty, income, and wealth. For example, it is argued that wealthy families can provide better learning opportunities to their children, since they can afford to send them to expensive elite schools and/or to pay for private tuition. On the other hand, parents in poor families cannot offer their children basic educational resources (e.g., textbooks, access to the internet, own desks).

Another group of explanations emphasizes the role of social relationships. Social capital theory argues that social networks and social relationships have a substantial impact on a variety of social outcomes (see Coleman, 1988). Explanations that focus on cultural differences and what these imply for student performance have also been provided. Bourdieu's theory of cultural capital (Bourdieu, 1973, 1984) is the most well-known theory that provides a cultural explanation about the effect of SES on student achievement. It is claimed that children from higher SES backgrounds are in a position to achieve better learning outcomes because they have similar cultural understandings to those which underlie the education system. Several studies provided support to this argument (Marks et al., 2006; Sullivan, 2001). Moreover, the mediating effect of the home learning environment to explain the impact of SES on student achievement is proposed. For example, Park (2008) conducted a secondary analysis of the Progress in International Reading Literacy Study (PIRLS) and revealed that after controlling for parental education and other individual characteristics, the index of early home literacy activities, the index of parental attitudes towards Reading and the number of books at home were associated with student achievement in Reading.

Finally, explanations concerned with the influence of school factors are supported by educational effectiveness studies which reveal that after controlling for student background factors such as prior achievement and SES, a substantial between-school variance can be observed (Kyriakides et al., 2006; Scheerens & Bosker, 1997). Studies on the summer learning gap and the influence of school tracking have also supported this explanation since their results seem to reveal that schools play an equalizing role (Cooper et al., 2003), especially since it is reported that the SES gap widens less during the

schooling period and more during summer holidays. This is due to the fact that disadvantaged students do not have access to challenging and fruitful learning activities during the long summer holidays, unlike their advantaged peers (Cooper et al., 1996; Kim, 2001; Lindahl, 2001). Consequently, quality summer schools targeting socially disadvantaged students can contribute to narrowing the gap between the performance of advantaged and disadvantaged students (Cooper et al., 2000; McCombs et al., 2011).

Moreover, researchers have studied how the SES gap changes over time for specific social policies and how it is mediated and moderated by risk and protective factors (e.g., Heath & Clifford, 1990; Kyriakides, 2005a; Willms & Raudenbush, 1989). These studies have implications for researchers on promoting equity in education since they reveal the importance of investigating the extent to which the SES gap can be altered by specific factors at the school and system levels (Willms, 2006). To search for variations in the effect of SES in different schools and countries, secondary analyses of international studies have been conducted (e.g., Caro & Lenkeit, 2012; Willms, 2003). This is partly due to the fact that the assumption that not only school factors but also system factors may explain variation on the effect of SES could not be tested by studies conducted in a single country. For example, PISA 2012 shows that across OECD countries, a more socioeconomically advantaged student scores 39 points higher in mathematics – the equivalent of nearly one year of schooling – than a less-advantaged student. In addition, across-country analysis of PISA revealed that almost 15% of the variance in student achievement can be explained by the PISA index of economic, social and cultural status. However, in some countries such as the Slovak Republic, Chile, Hungary, and Peru, this index can explain more than 22% of the variance in student achievement whereas in other countries such as Macao-China and Qatar this index can explain no more than 6% of the variance. Furthermore, the various PISA cycles reveal that the impact of SES on student achievement varies significantly across countries (Schleicher, 2014).

Moreover, Huang and Sebastian (2015) conducted a secondary analysis of PISA 2012 and examined the role of schools in bridging within school SES gaps in achievement. Although almost all countries (i.e., 60 out of 61) had SES gaps, the school variance in SES gaps was significant in only 16 countries. Moreover, the variables measuring head teachers' perceptions of the school climate and leadership were not found to account for the success of those schools where SES had a smaller effect on student achievement than their country norms. It was therefore argued that schools may have limited ability in reducing the impact of SES on student achievement. On the other hand, Marks et al. (2006) conducted a secondary analysis of PISA 2000 and revealed that in many countries,

educational differentiation—that is, school tracks and school types, and curriculum tracking within schools—mediates the relationship between socioeconomic background and student achievement. Countries with highly tracked systems tend to show stronger relationships. On average, over 60% of the effect of socioeconomic background on achievement is accounted for by these factors. These findings are independent of whether achievement in Reading, Mathematics, or Science is examined. Furthermore, Chudgar and Luschei (2009) conducted a secondary analysis of TIMSS 2003 and examined variation among schools in the SES–achievement relationship in 4th grade in 25 countries. It was found that in some countries schools can reduce SES-based achievement gaps. It was also shown that this ability is not related to a country's economic or inequality levels. The different results reported by these three secondary analyses could be attributed to the fact that different indicators were used in measuring the SES effect on student achievement. Moreover, each secondary analysis searched for the effect of different school factors. For example, Huang and Sebastian (2015) searched for the effect of school climate and leadership, but two recent meta-analyses of school effectiveness studies indicated that leadership and school climate have a very small effect on student achievement gains (Hendriks & Scheerens, 2013; Kyriakides et al., 2010). Single country studies also reveal different findings on the impact that schools may have in reducing SES gaps in student achievement. Nevertheless, differential school effects of SES are reported by most national studies (e.g., Creemers & Kyriakides, 2015; Frempong et al., 2011; Scheerens & Bosker, 1997).

Additionally, empirical studies seem to reveal that there is a need to search for the impact of interactions between SES and other student background factors (Kyriakides, 2007; Strand, 2010). For example, there are studies which reveal a weaker association of family SES with educational attainment for students with immigrant background than for those without immigrant background (e.g., Kingdon & Cassen, 2010; Strand, 2014a, 2014b). Thus, in the fourth part of this chapter the impact of student level factors which are presented as part of the dynamic model of educational effectiveness (Creemers & Kyriakides, 2008) is outlined. In this way, the reader can be familiarized with other factors beyond SES that may be responsible for unjustifiable differences in student learning outcomes and also search for the relations that may exist among these student level factors especially since the dynamic model is based on the assumption that factors operating at each level are related to each other (Creemers & Kyriakides, 2006).

Summing up, each individual school in every country is facing a challenge to identify ways for promoting not only quality but also equity. In an effective school, access

to resources and opportunities to learn should ensure the successful learning of all learners implying that school failure will not be determined by factors that students cannot control such as their own socioeconomic background. The importance of using equity and quality as dimensions for measuring school effectiveness is discussed in the next part of this chapter by providing explicit definitions of these two concepts of EER and then searching for their relationship. In this way, one could understand that not only emphasis to the progress of students in different learning outcomes (quality dimension) should be given but also to the reduction of the gap in learning outcomes among students with background differences (equity dimension).

Quality and Equity Dimensions: Definitions and Research Findings

Definitions of the Dimensions of Measuring Educational Effectiveness

Definitions of the concepts of quality and equity should be provided in order to clarify what schools can do in order to promote both of them. Since schools are first and foremost places where learning takes place, the objectives of education are primarily *student learning outcomes*. Schools and teachers should be supported in such a way that educational objectives are reached and educational quality becomes a fact. In this context, research can offer insight into which factors can contribute to student results. Therefore, the term learning outcomes is used in a broader sense and both quality and equity are treated as criteria for measuring effectiveness in schools.

In the case of the *quality dimension*, student achievement gains in the cognitive, affective, psychomotor and meta-cognitive domains are examined. It is expected generally in society that education should achieve high results in those domains. This means that the criteria for effectiveness will be at the level to be obtained by individual students, classes, and schools with respect to those objectives (*excellence*). Although many studies have been conducted investigating the affective outcomes of schooling (Knuver & Brandsma, 1993; Kyriakides, 2005a; Opdenakker & Van Damme, 2006) and the development of psychomotor skills (Kyriakides & Tsangaridou, 2008), researchers have not yet been able to observe student progress across the full range of the school curriculum. Moreover, they have not examined educational effectiveness in relation to the newer goals of education, such as the development of meta-cognitive skills (Kyriakides et al., 2020). Also, there is a question on the quantity of knowledge that is important to acquire. Especially in times of economic decline, there is always a tendency to go back to “the basics”. Basic skills initially stood as key outcomes within EER, especially because disadvantaged students did

not succeed well enough in these skills (Brookover et al., 1979; OECD, 2012). As long as we do not deny the importance of basic knowledge and skills, more than basic knowledge should certainly be added to the objectives and the goals of education in schools. But, based on research on metacognition (Prawat, 1989), it is evident that, for higher order learning, basic learning and basic knowledge are required in the first place. Therefore, schools must ensure that a basic knowledge for all students is available so that students can subsequently acquire and develop other types of knowledge and skills especially in the areas of the transferability of knowledge, the evaluation of knowledge, the synthesizing of knowledge, and the area of metacognitive knowledge (Creemers, 1994; Levine & Lezotte, 1990; Teddlie & Stringfield, 1993). Studies conducted in the field of EER have shown that schools which are effective in promoting cognitive outcomes tend to also be effective for affective outcomes by helping students to develop positive attitudes towards schooling (Knuver & Brandsma, 1993; Kyriakides, 2005a).

In regard to the way that quality dimension is measured, an approach that acknowledges the complex and multilevel structure of education should be taken into account. Since students are nested into classes, classes into schools and schools into educational systems, a researcher that ignores this nesting of data can be lead to incorrect interpretations about the relations among variables that he/she is studying (Heck & Thomas, 2020). Multilevel modelling techniques have been used during the past decades to investigate the impact of effectiveness factors on student learning outcomes (Goldstein, 2003; Raudenbush & Bryk, 1986). Multilevel modelling allows the researcher to investigate the extent to which clustering effects are present in the data, for example if the variation in achievement can be divided into individual-level and group-level components. Additionally, multilevel modelling provides a framework in which a researcher can add explanatory variables at their correct level of the data order by avoiding aggregating or disaggregating the data to a single level of analysis (Heck & Thomas, 2020). Finally, multilevel regression modelling allows the researcher to investigate to what extent students improve their learning in each school by taking into account that schools differ in the manner in which the long-term learning effects may vary for students with different levels of initial educational attainment and backgrounds (Sammons et al., 1995). As Willms and Kerckhoff (1995) suggest, this can be seen as value-added approach that is, the extent to which schools vary in producing learning outcomes, by considering student entry variables (e.g., SES, prior achievement). To produce this type of analysis, test scores must be collected on multiple occasions for students (i.e. at the beginning and at the end of a school year) for capturing the rate of progress over time within each school. By doing so, one can

explore how effectiveness factors situated for example at the school level, can have an impact on student achievement outcomes, as well as investigate the stability of these factors in explaining student improvement over time (Creemers & Kyriakides, 2010b). These techniques underline that policies and procedures to compare schools can give different impressions as to which schools are really adding value to students' learning.

In regard to the *equity dimension*, it is taken into account that numerous definitions have been provided through early studies in the field of EER. Farrel (1999) in his attempt to explain the term, distinguishes equity to four dimensions: a) equal as to the degree of access of children from different socioeconomic levels in the educational system (equality of access), b) equal as to the percentage of students from different socioeconomic levels completing each level of education (equality of survival), c) equal as to the degree to which students from different socioeconomic levels have the potential to reach the same academic level (equality of output) and d) equal as to the degree to which students from different socioeconomic levels have the same rights and professional opportunities corresponding to the level of their education (equality of outcome). Demeuse et al. (2001), Levin (1995, 2003), and Lewis and Lewis (2008), discriminate equity in a similar way and specify that a commitment to equity suggests that differences in outcomes should not be attributable to differences in areas such as wealth, income, power, or possessions. However, it is important to say that in each of the above "criteria" for measuring equity, the final student outcomes which are used as measurement criteria of equity, do not only depend on the influence of the school. The final learning outcomes also depend on the initial performance of students and therefore one would be too ambitious to expect that all differences among students could be eliminated. Nevertheless, all four "criteria" for measuring equity mentioned above could be addressed by using value-added models of assessment which take into consideration the progress made by each student instead of their final results. Adopting this approach, the measurement of equity becomes an educational benchmark in all stages of student attendance.

The most recent definitions given by the European Union (2006) and the OECD (2013b), give emphasis on value-added forms of assessment to measure equity. Specifically, the European Union (2006) states that:

> Equity is viewed as the extent to which individuals can take advantage of education and training, in terms of opportunities, access, treatment and outcomes. Equitable systems ensure that the outcomes of education and training are independent of socioeconomic background and other factors that lead to educational disadvantage and that treatment reflects individuals' specific learning needs. Inequity in relation

> to gender, ethnic minority status, disability and regional disparities etc. is not the prime focus here, but is relevant as far as it contributes to overall socioeconomic disadvantage. (p. 2)

Similarly, PISA defines equity dimension as below:

> PISA defines equity in education as providing all students, regardless of gender, family background or socioeconomic status, with opportunities to benefit from education. Defined in this way, equity does not imply that everyone should have the same results. It does mean, however, that students' socioeconomic status or the fact that they have an immigrant background has little or no impact on their performance, and that all students, regardless of their background, are offered access to quality educational resources and opportunities to learn. (OECD, 2013b, p. 13)

It is apparent from the definitions above that many scholars stress the importance of equality of opportunity to learn and define equity as providing to all students, sufficient opportunity to fully develop regardless of their background (Roemer, 1998; Van den Branden, 2012). However, several other researchers (e.g., Boaler, 2008; Gutierrez, 2002; Post, 2004) are focused only on the existence of equity in the final learning outcomes without considering the initial gap between students and without considering the way equity is varied from one school to another whilst at the same time managing to improve quality of education.

Taking all the above into consideration, two opposite sites have emerged as regards to the way quality and equity are promoted. One debate on promoting quality and equity is focused on political issues associated with how an educational system should deal with differences in school population and it is concerned with the provision of inclusive education or with the use of the streaming approach in education for supporting adaptation of education to the different needs of students. These two approaches look at differences in the socio-cultural background of students and variables such as SES and ethnicity are taken into account in promoting specific ways of delivering education at the school level. The second debate is concerned with individual differences within the school population on abilities, motivation, and expectations. Identifying initial differences in relation to these background variables has resulted in debates on whether more emphasis should be given to less able children (who usually have lower expectations) in order to help them achieve the basic learning outcomes and develop positive attitudes towards schooling or whether more emphasis should be given to abler children resulting in promoting elitisms in education. Within this debate, a group of researchers in psychology, sociology, and economy of

education treated quality and equity as competing each other and supported different approaches on how to deal with the "cost" of promoting the one rather the other (Whitty, 2001). This can partly be attributed to the fact that the equity dimension was rarely explicitly defined and consequently there is not enough evidence investigating the relation between the two dimensions of effectiveness in classrooms, schools and educational systems (Kelly, 2012; Kyriakides & Creemers, 2011).

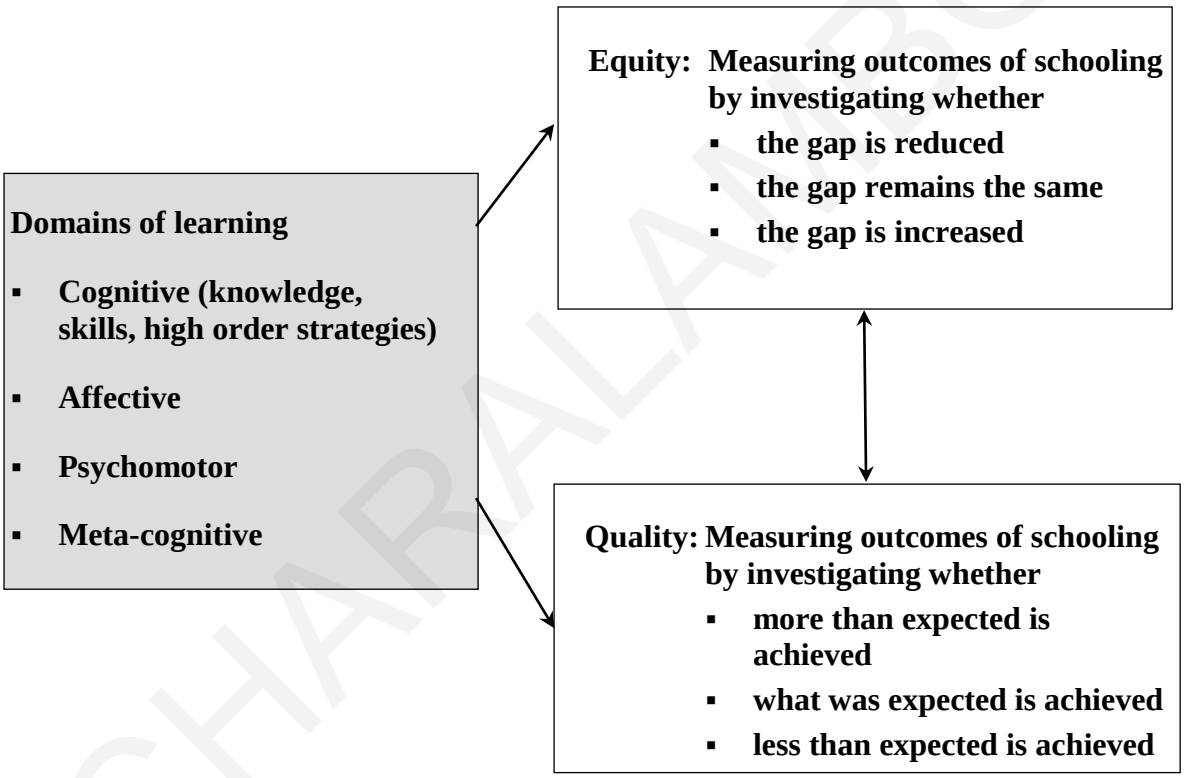
Summing up, equity in education could be examined in two ways that are closely linked and can help researchers analyse the implications of school failure for teachers/schools/systems: equity as *fairness* and equity as *inclusion*. Specifically, school failure can be seen as twofold. On the one hand, school failure could be seen as the failure of an educational system, which is unable to provide an education of quality to all. In this case, overcoming school failure implies assuring *inclusion*. Inclusion means ensuring that all students participate in education in an adequate and effective way (Ballarino et al., 2014) and consequently a basic minimum standard education is ensured for each and every student. The inclusion perspective has implications for designing effective national reform policies that minimize dropout rates and provide learning opportunities for all children. Secondly, school failure can be attributed to factors beyond those that students can control and are associated with student learning outcomes. In this case, *fairness*, as the second way of examining equity in education, suggests that personal and social circumstances, such as gender, SES or ethnic origin should not be an obstacle to educational success (Ballarino et al., 2014; Field et al., 2007).

In this study, equity is seen as related with ***fairness***. Consequently, the equity dimension of effectiveness in education demands that students' expected learning outcomes should depend only on their own effort and capacity, and not on considerations over which they have no influence. *This implies that teacher/school/system effectiveness status can be measured by looking at the extent to which unjustifiable differences in learning outcomes are reduced.* This is in line with how many scholars define equity; as the closing of achievement gaps between students coming from different socioeconomic backgrounds (Causa & Chapuis, 2009; Lynch & Oakford, 2014; Van de Werfhorst & Mijs, 2010; Zuzovsky, 2008). This could be achieved by examining the extent to which the variance in student learning outcomes between students of a single class/school/system is reduced and thereby indicators for measuring teacher/school/system effectiveness in terms of equity could emerge. Specifically, the focus of the present study, is at the school level and therefore, the percentage of variance in student learning outcomes between students of a *school* will be examined.

Figure 2.1 presents the two dimensions of measuring effectiveness concerned with outcomes of schooling, implying that effectiveness studies should search for any interaction between the two dimensions. Thus, in the last section of this part, research findings on the relation between quality and equity are discussed.

Figure 2.1

Dimensions of Measuring Effectiveness Concerned with Outcomes of Schooling {Adopted from Creemers and Kyriakides (2008)}



Research Findings on the Relation Between Quality and Equity

By introducing two different dimensions of measuring effectiveness, a question that arises is the extent to which teachers/schools/systems can be effective in terms of both quality and equity. Based on the knowledge base about quality education, effective schools are able to promote the learning of their students but may not have a special impact on the disadvantaged students (Kyriakides, 2007). The research concerned with the influence of schools on different groups of students i.e. (differential effectiveness research), results in

the conclusion that those who have high results in achieving educational objectives in general do this for specific groups, but they cannot significantly decrease the variance within classrooms between students (Campbell et al., 2004; Teddlie & Reynolds, 2000). However, research into educational effectiveness reveals that in some countries teachers and schools matter most for underprivileged and/or initially low-achieving students (Kyriakides, 2007; Scheerens & Bosker, 1997; Vanlaar et al., 2016). This reveals the importance of using both dimensions of measuring effectiveness in evaluating teachers/schools/systems and in building theoretical models of educational effectiveness which could refer to factors promoting both quality and equity in education.

In particular, results of a study conducted by Kyriakides and Creemers (2011), showed that effective schools as to the equity dimension were equally effective as to the quality dimension and none of the schools has failed to improve its effectiveness in relation to the equity dimension and reduce its effectiveness in relation to the quality dimension. Hence, promoting one of the two dimensions does not mean that this could negatively affect the other one, but rather the opposite since the relationship between them appears to be linear. This is in line with the results of the PISA study that "consistently finds that high performance and greater equity in education opportunities and outcomes are not mutually exclusive: one does not have to be sacrificed to achieve the other" (OECD, 2013b, p. 27). However, recent experimental studies in the field of EER have been conducted to identify effectiveness factors in relation to the quality dimension based on the dynamic model of educational effectiveness (Creemers & Kyriakides, 2012), but none of them has explored factors that might improve the equity dimension as well.

A secondary analysis of various cycles of PISA (2000, 2003, 2006, 2009 and 2012) conducted by Kyriakides, Charalambous et al. (2015) showed that the achievement gap (in three different subjects - Reading, Mathematics and Science) based on the highest parental occupation among the two parents (HISEI) tends to be smaller in countries which achieve better learning outcomes (after controlling for HISEI). These findings show that the achievement gaps based on HISEI were smaller in more effective schools in terms of their overall student achievement (after controlling for the effect of HISEI). Thus, these across-country analyses seem to support the argument that schools and countries in which this indicator of SES (=HISEI) has smaller effect on achievement tend to be more effective than others in terms of achieving better final student learning outcomes. Finally, stronger relations between the dimensions of quality and equity at the school rather than at the country level have been identified. The weak relationship at the country level could be partly attributed to the various socio-cultural factors beyond those that could be monitored

by national policy makers in their attempt to provide equal opportunities (Micklewright & Schnepf, 2007). Beyond the establishment of effective policies on promoting equal educational opportunities to students in socially-disadvantaged areas, factors associated with the wider educational environment (Willms, 2003) may also contribute to explaining the variation of the achievement-gap based on SES at country level. Nevertheless, this assumption cannot be tested through PISA or other international studies since these studies do not collect data on the quality of the national policy and the actions that policymakers take to provide equal opportunities to students in socially disadvantaged areas. Secondary analyses of PISA are mainly concerned with factors measuring perceptions of the school climate and of leadership, but these were not found to explain within-school and within-country variations in student achievement gaps based on SES (Huang & Sebastian, 2015). What should be noticed is that this relationship between quality and equity can be identified only if one focuses on the consistent results emerging from the use of HISEI as an indicator of the SES. Previous studies considered only the statistical significance of the variation among schools in SES gaps to evaluate whether schools can play a bridging role (Chudgar & Luschei, 2009).

To conclude, almost no study has been found to *empirically* examine the relationship between quality and equity (Kyriakides & Creemers, 2011) and very few researchers address this issue conceptually (Frempong et al., 2011; Van de Werfhorst & Mijs, 2010). For example, Ainscow (2010) points out that equity and policies for excellence are two sides of the same coin and rather than making ultimate choices between these two, the concern of policy-makers could be to find specific actions which will enable both to be pursued at the same time. The results of the above mentioned studies, showed that there is a need to conduct studies investigating this relationship within and across countries to increase stakeholders' awareness about the importance of reducing the SES gap in student achievement especially in those countries and schools where final student learning results can be considered satisfactory but SES still plays a very important role for achieving these results. Hence, the results of the present European study on the relation between the two dimensions may help policy makers evaluate policies on promoting quality and equity since they could search not only for the extent to which students' mean performance has been improved but also whether the SES gap in student achievement has been reduced.

The Dynamic Model of Educational Effectiveness as the Theoretical Framework of the Study

The following section refers to the main assumptions and elements of the dynamic model of educational effectiveness which forms the theoretical framework of this study, as well as to the empirical evidence supporting its main assumptions which emerged from empirical studies and meta-analyses. This is followed by a discussion of the main factors included at the student level of the model which are presented in the next section.

Rationale, Essential Characteristics and Validity of the Model

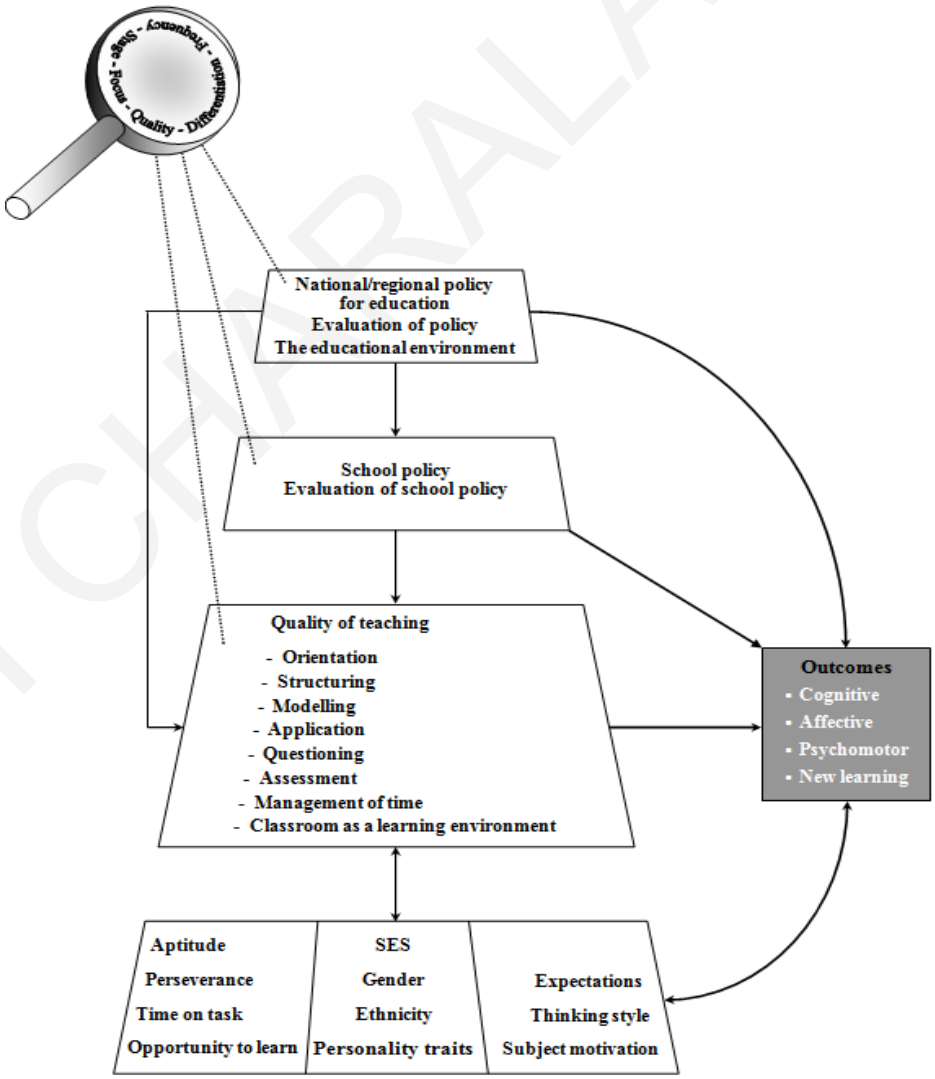
The development of the dynamic model of educational effectiveness (Creemers & Kyriakides, 2008) is based on the results of a critical review of the main findings of the studies in the field of EER as mentioned in the previous parts of this chapter and of a critical analysis of theoretical models of educational effectiveness which were developed during the 1990s (e.g., Creemers, 1994; Scheerens, 1992; Stringfield & Slavin, 1992). The need to develop and test the theoretical models of educational effectiveness arises from the fact that any theoretical model should serve to elucidate previous empirical research parsimoniously and map a series of avenues for future research which may help expand researchers' knowledge base of educational effectiveness and provide a useful guide for practitioners to improve the effectiveness of their schools. The models developed in the 1990s had a multilevel structure, made use of organisational theories and theories of learning and refer to multiple factors at different levels. But, each of them was either focused on the classroom or the school level and examined the extent of teacher and school effects overall by paying very little attention to the extent to which teachers and schools perform consistently across different school groupings. Additionally, those models of effectiveness did not clearly refer to the measurement of each effectiveness factor, as it was assumed that these factors represent unidimensional constructs.

Taking into account the above, it is essential that the new models of EER should take into account the new goals of education and contribute significantly to the improvement of school effectiveness (van der Werf et al., 2008). Some characteristics of the comprehensive model (Creemers, 1994) were the preliminary points for the development of the dynamic model of educational effectiveness (see Figure 2.2), which attempts to address weaknesses of the previous models (Kyriakides, 2008). The dynamic model is based on the following three main assumptions. First, it is taken into account that many effectiveness studies are exclusively focused on Language or Mathematics rather than on the whole school curriculum subjects. Consequently, in the dynamic model, effectiveness is defined by

taking into account cognitive, psychomotor, metacognitive and affective outcomes. Second, an important limitation of the existing approaches of modelling school effectiveness is the fact that the entire process does not contribute significantly to the improvement of school effectiveness. Hence, the dynamic model is established in a way that helps both policy makers and practitioners to improve educational practice through coherent choices regarding the ideal fitting of the factors within the model and the present situation in schools (Creemers & Kyriakides, 2010a). Third, the dynamic model is not only parsimonious but also able to describe the complex nature of educational effectiveness. This means that the model is based on specific theory, but at the same time some of the factors included in the major constructs of the model are expected to be interrelated within and/or between levels.

Figure 2.2

The Dynamic Model of Educational Effectiveness {Adopted from Creemers and Kyriakides (2008)}



Continuing with the main five characteristics of the dynamic model, it is first of all multilevel in nature which means that it refers to factors associated with student learning operating at different levels (*student, classroom, school and system*). Teachers' actions and students' characteristics and behaviours are illustrated and above these two levels the main components of the school policy are identified. School-level factors have an impact on teacher and student level factors by establishing and evaluating the school policy on teaching and the policy on creating a learning environment at the school. The system level refers to the impact of a country's educational system through developing and evaluating the educational policy at the national/regional level.

Second, the dynamic model does not only show the relationship between each level with the students' learning outcomes, but also the interrelations between the components of the model. This means that factors at the school and system level have both direct and indirect effects on student outcomes since they are able to influence the classroom level factors as well (Kyriakides & Creemers, 2012).

Third, the impact of the school- and system- level factors is defined and measured in a different way than the impact of classroom-level factors. School policy on teaching should be measured over time and in relation to the needs of each school. Schools which are able to recognise their strengths and weaknesses and develop a policy on aspects associated with teaching and their learning environment, are also able to improve their effectiveness status. In this way, the dynamic model can be useful in supporting school stakeholders (school leaders, teachers, parents and students) realise that they can actively contribute to the promotion of positive student learning outcomes. It therefore has implications for school leaders, teachers and parents as they try to improve school, classroom and home learning environment and contribute by doing this to school reform in order to improve student learning outcomes (Robinson et al., 2009; Smith & O'Day, 1990).

Fourth, relationships between the effectiveness factors situated at the same level are examined. For example, at the classroom level, a study conducted by Kyriakides et al. (2009), showed that the eight teaching factors can be grouped into five types of teacher behaviour which are discriminated in a unique way and move progressively from skills associated with direct teaching to more advanced skills concerned with new teaching approaches and differentiation of teaching. Teachers situated in the higher levels have better student outcomes.

Fifth, the effectiveness factors of the dynamic model are considered to be multidimensional constructs in order to provide a better picture of what makes teachers and schools effective. Specifically, the model presents a specific framework for measuring the

functioning of factors which comprises five measurement dimensions: *frequency*, *focus*, *stage*, *quality* and *differentiation.* The *frequency* dimension refers to the quantity that an activity associated with an effectiveness factor is present in a system, school, or classroom. This is probably the easiest way to measure the effect of a factor on student achievement.

The factors are also measured by taking into account the *focus* of the activities associated with a factor. For example, in the case of school policy on parental involvement, the policy could either be more *specific* in terms of concrete activities that are expected to take place (e.g., it refers to specific hours that parents can visit the school) or more general (e.g., it informs parents that they are welcome to the school but without giving them specific information about what, how, and when). Moreover, an activity may be expected to achieve a *single or multiple purposes*. In the case of school policy on parental involvement, the activities might be restricted to a single purpose (e.g., parents visit schools to get information about student progress). On the other hand, the activities might be addressed to more than one purpose (e.g., parents visit the school to exchange information about children's progress and to assist teachers in and outside the classroom). A balance between specific and general tasks should exist. For example, the guidelines on parental involvement, which are very general, may not be helpful either for parents or teachers in establishing good relations which can result in supporting student learning. On the other hand, a school policy which is very specific in defining activities may restrict the productive involvement of teachers and parents in creating their own ways of implementing the school policy. Similarly, if all the activities are expected to achieve a single purpose, then the probability of achieving this aim is high, but the effect of the factor might be small due to the fact that other purposes are not achieved and synergy may not exist. On the other hand, if all the activities are expected to achieve multiple purposes, there is a danger that specific purposes are not addressed in such a way that they can be implemented successfully (Creemers & Kyriakides, 2010a).

Also, the activities associated with a factor can be measured by taking into account the *stage* at which they take place. Factors need to take place over a long period of time to ensure that they have a continuous direct or indirect effect on student learning. For example, school policy on student absenteeism is expected to be implemented throughout the year and not only through specific regulations announced at a specific point of time (e.g., only at the beginning of the school year). It is also expected that the continuity will be achieved when the school is flexible in redefining its own policy and adapting the activities related to the factor by taking into account the results of its own self-evaluation mechanism.

The *quality* dimension can be determined in two different ways. The first one refers to the properties of the specific factor itself, as these are discussed in the literature. For instance, school policy on assessment can be measured by looking at the mechanisms which have been developed in order to establish instruments which meet psychometric standards (e.g., valid, reliable, representative to the content taught). At the same time, this policy should ensure that teachers are expected to make use of the information gathered from assessment in order to meet their student's needs. In this way, the school policy gives more emphasis to the formative function of assessment.

Finally, *differentiation* refers to the extent to which activities associated with a factor are implemented in the same way for all the subjects involved with it. The importance of treating differentiation as a separate dimension of measuring effectiveness factors arises from the fact that students of any age and in any culture will differ from one another in various intellectual and psychomotor skills, in both generalised and specialised prior knowledge, in interests and motives, in their socioeconomic background, and in personal styles of thoughts and work during learning (Dowson & McInerney, 2003). Thus, adaptation to specific needs of each subject or group of subjects will increase the successful implementation of a factor and will ultimately maximize its effect on student learning outcomes. Head teachers are, also, expected to adapt their leadership to the specific needs of the teachers and other school stakeholders (e.g., parents, pupils) by taking into account the extent to which they are ready to implement a task. For example, information to parents (e.g., information letters about the school policy, regulations, excursions, activities, etc.) should be available to them in different ways such as written in their mother tongue (if they do not speak or understand English), orally through telephone communication, and online by email. The differentiation dimension does not imply that the subjects are not expected to achieve the same purposes. On the contrary, adapting the policy to the special needs of each group of schools, teachers, or students may ensure that all of them will become able to achieve the same purposes.

Summing up and by taking into account all the aforesaid characteristics of the dynamic model, it is essential at this stage to point out that this study uses this model as its theoretical framework for the following reasons:

1. ***The model acknowledges the importance of using both quality and equity dimensions when measuring effectiveness.*** The dynamic model takes into consideration the early school effectiveness research and school improvement projects that had been strongminded by the idea of creating effective schools for the urban poor (Edmonds, 1979). It also supports the idea behind this is which

is that education can contribute to social justice and democracy by closing the gap between students with regards to their background, especially their abilities and the sociocultural status of their family. As a consequence, the model does not only focus on improving student learning outcomes (quality) but also on reducing the achievement gap between students coming from different socioeconomic backgrounds (equity), which is the main objective of this study.

2. ***The model uses differentiation dimension as one of the ways measuring the functioning of the effectiveness factors.*** The *differentiation* dimension is concerned with the extent to which further support is provided by the school to students who need it more. This dimension shows that the dynamic model supports that policy-makers should give special emphasis to the provision of equal opportunities to students and identify the extent to which schools manage to reduce the variance in student outcomes between students coming from different socioeconomic backgrounds. Since this is one of the main aims of this study, the importance of the differentiation dimension is highlighted through the intervention process.
3. ***The model refers to school and student level factors.*** The main purposes of this study is to examine whether the school can make a difference in improving its students' learning outcomes if changes in the functioning of the school policy occur (school level factors) and to reduce unjustifiable differences in outcomes of schooling (promoting equity). This implies that personal or socioeconomic characteristics (student-level factors) should not be obstacles to success in education, and therefore this study concentrates on how school can reduce their impact on student outcomes.

Various national and international studies as well as two meta-analyses were conducted since the establishment of model to test its validity. More specifically, 21 empirical studies have been conducted to test the main assumptions of the dynamic model with regard to the factors included in the model, the use of the five dimensions to measure the functioning of these factors, as well as to the relationships among factors operating at the classroom level (see Table 2.1). It is important to mention that none of these studies or meta-analyses has generated negative results with regard to any assumption of the dynamic model and none of these studies has revealed any negative effect of any factor and/or its dimensions on any type of student learning outcomes. Additionally, all studies have provided empirical support for the multilevel nature of the dynamic model since factors operating at different levels have been found to be associated with student achievement.

This is a mutual outcome for all effectiveness studies conducted during the last two phases of EER and reveals the importance of considering the nested nature of education when analysing the data of effectiveness studies (Creemers et al., 2010). A detailed review of all the studies mentioned in Table 2.1 can be found in Kyriakides et al. (2021). Moreover, the model has received empirical support from theoretical reviews (see Heck & Moriyama, 2010; Hofman et al., 2010; Sammons, 2009; Scheerens, 2013).

All the aforementioned studies reveal that factors included in the dynamic model are associated with achievement gains in different student learning domains (quality dimension). However, none of these studies has examined the extent to which the factors of the dynamic model are associated with reducing the achievement gap between students (equity dimension). Since research also suggests that the greatest difference can be made in schools that are in underprivileged communities and/or initially low-achieving students (Kyriakides, 2007; Reynolds et al., 2014), the present study provides empirical support to the validity of the model in relation to the equity dimension.

In the next two sections of this part, the student and school level factors of the dynamic model are described in detail. Since one of this study's main aims is to reduce unjustifiable differences in outcomes of schooling, which implies that personal or socioeconomic characteristics should not be obstacles to success in education, the impact of background factors on student learning is explored. Specifically, it is stressed that some student factors, such as student motivation and expectations, are likely to change so the school management team and the teachers should take targeted actions to improve motivation and expectation. This can also be done indirectly by providing relevant guidelines and support to students and parents. Other student factors are not likely to change (e.g., socioeconomic status, ethnicity, gender) but schools should be aware of how these factors affect learning in order to adapt their policy to the special needs of students coming from different backgrounds. In addition, they should help parents and students to improve their home learning environment especially those coming from low SES background. Finally, discussion about the school level factors of the model and the way they affect student achievement takes place by describing the elements of each one of the overarching factors.

Table 2.1

Empirical Evidence Supporting the Main Assumptions of the Dynamic Model Emerging from Empirical Studies and Meta-Analyses

Assumptions of the Dynamic model	Empirical Studies	Meta-Analyses
1. Multilevel in nature	All	All
2. Five dimensions can be used to measure		
a) teacher factors	1, 2, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 16, 20	
b) school factors	1, 3, 4, 17, 19	
3. Impact of teacher factors on learning outcomes	1, 2, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 16, 17, 20, 21	2
4. Impact of school factors on learning outcomes	1, 3, 4, 17, 18, 19	1
5. Impact of system factors on learning outcomes	15	
6. Situational character of school factors	1	
7. Relationships between factors operating at the same level: stages of effective teaching (including assessment)	1, 5, 6, 7, 8, 9, 10, 21	2
8. Changes in the functioning of school factors predict changes in the effectiveness status of schools	3, 19	
Negative results in relation to any assumption	None	None

Studies:

1) A longitudinal study measuring teacher and school effectiveness in different subjects (i.e., mathematics, language and religious education) and different learning domains (cognitive and affective) (Kyriakides & Creemers, 2008).
2) A study investigating the impact of teacher factors on achievement of Cypriot students at the end of pre-primary school (Kyriakides & Creemers, 2009).
3) A follow-up study testing the validity of the dynamic model at the school level by looking at the extent to which changes in the functioning of school factors can predict changes in the effectiveness status of schools in different subjects (i.e., mathematics and language) (see Creemers & Kyriakides, 2010b).
4) A European study testing the validity of the dynamic model at teacher, school and system level (Panayiotou et al., 2014).
5) A study in Canada searching for grouping of teacher factors included in the dynamic model and revealing specific stages of effective teaching (Kyriakides, Archambault, & Janosz, 2013).
6) An experimental study investigating the impact upon student achievement of a teacher professional development approach based on the dynamic approach (Antoniou & Kyriakides, 2011).
7) Examining not only the impact but also the sustainability of the dynamic approach on improving teacher behaviour and student outcomes (Antoniou & Kyriakides, 2013).
8) Searching for stages of teacher's skills in assessment (Christoforidou et al., 2014).

9) The effects of two intervention programmes on teaching quality and student achievement revealing the added value of the dynamic approach (Azkiyah et al., 2014).
10) Using the dynamic model to identify stages of teacher skills in assessment in two different countries (Cyprus and Greece) (Christoforidou & Xirafidou, 2014).
11) Using observation and student questionnaire data to measure the impact of teaching factors on mathematical achievement of primary students in Ghana (Azigwe et al., 2016).
12) Examining the impact of teacher behaviour on promoting students' cognitive and metacognitive skills (Kyriakides et al., 2020).
13) Investigating the impact of teacher factors on slow learners' outcomes in language (Ioannou, 2018).
14) Integrating generic and content-specific teaching practices when exploring teaching quality in primary physical education (Kyriakides, Tsangaridou et al., 2018).
15) A European study looking at the impact of national educational policies on student achievement (Kyriakides, Georgiou et al., 2018).
16) A longitudinal study investigating for the short- and long-term effects of the home learning environment and teacher factors included in the dynamic model on student achievement in mathematics (Dimosthenous et al., 2020).
17) A case study of policy and actions of Rivers State, Nigeria to improve teaching quality and the school learning environment (Lelei, 2019).
18) Exploring school resource and teacher qualification policies, their implementation and effects on schools and students' educational outcomes in Brazil (Paget, 2018).
19) A longitudinal study investigating the impact of school policy and stakeholders' actions on student achievement gains in mathematics (Kyriakides, Creemers et al., 2015).
20) Do teachers exhibit the same generic teaching skills when they teach in different classrooms (Kokkinou & Kyriakides, 2018).
21) A longitudinal study on the impact of instructional quality on student learning in primary schools of Maldives (Musthafa, 2020)

Meta-Analyses:

1) A quantitative synthesis of 67 studies exploring the impact of school factors on student achievement (Kyriakides et al., 2010).
2) A quantitative synthesis of 167 studies investigating for the impact of generic teaching skills on student achievement (Kyriakides, Chirstoforou, & Charalambous, 2013).

The Impact of Student Level Factors on Student Achievement

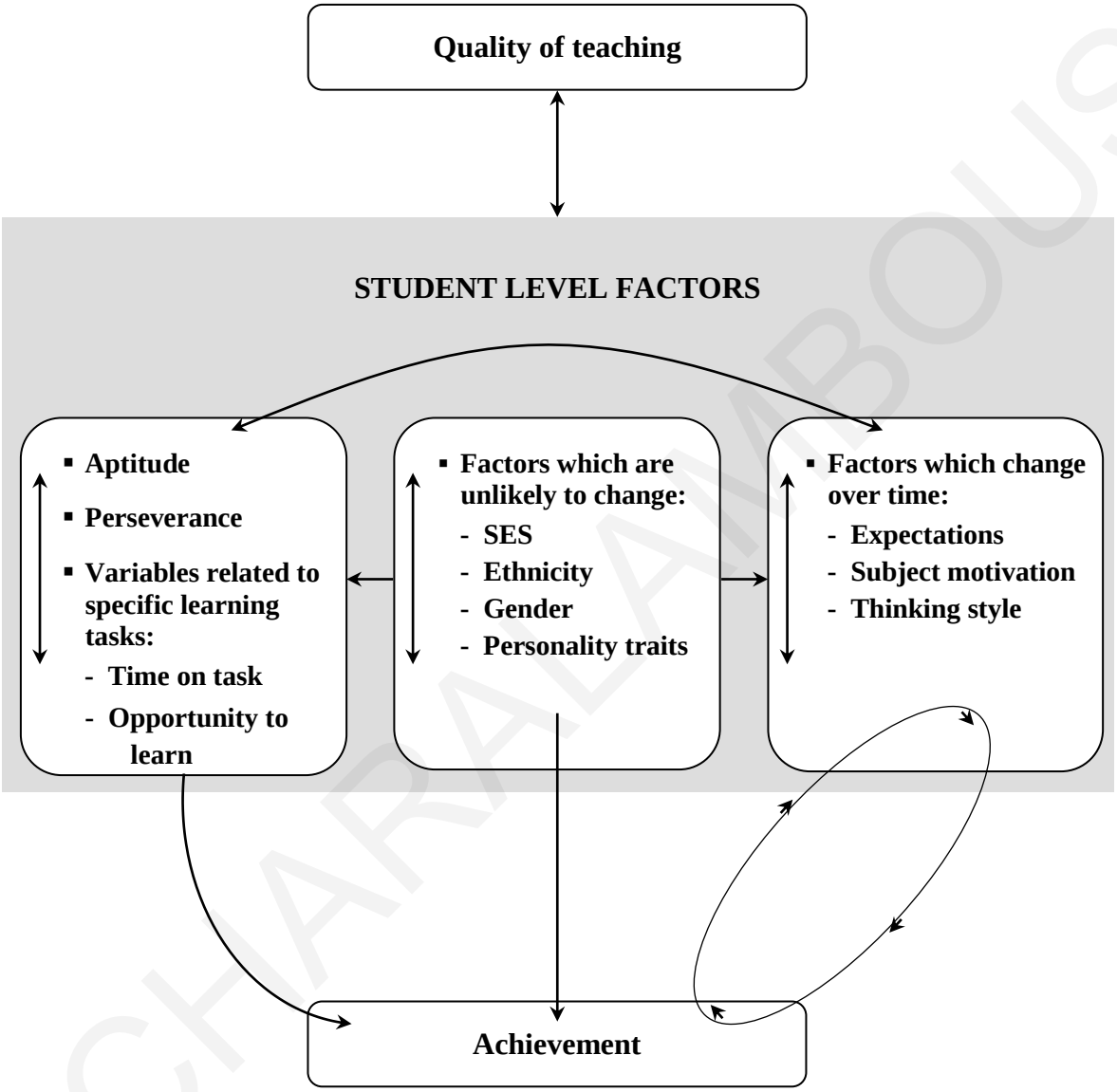
This section provides a description of the factors of the model situated at the student level. Specifically, it is stressed that student background characteristics should be taken into account because they explain to a large extent the difference between students in learning and achievement. The dynamic model refers to three categories of these background factors (see Figure 2.3):

- Sociocultural and economical background variables emerged from the sociological perspective of EER.
- Background variables emerged from the psychological perspective of EER.
- Variables related to specific learning tasks emerged from the psychological perspective of EER.

Figure 2.3 shows that a distinction is made among the student-level factors by referring to factors which are unlikely to change (e.g., gender, SES, ethnicity, personality) and factors that may change over time (e.g., subject motivation and thinking styles). For example, subject motivation may be related with student achievement gains, but it is also likely to change due to the teacher behaviour (Bamburg, 1994). Helping children to increase their motivation could be considered as an affective outcome of schooling (Van der Werf et al., 2008). Especially in the case of students with low SES, where they have less opportunities to be motivated at home, teachers could adapt their teaching practice to the specific learning needs of this group of students and try to increase their motivations.

Figure 2.3

Factors of the Dynamic Model Operating at the Student Level {Adopted from Creemers and Kyriakides (2008)}



- ***Sociocultural and economic background factors***

The first group of student level factors refers to the sociocultural and economic background characteristics of students, such as SES, ethnicity and gender. Many studies showed that a large percentage of variance in student outcomes could be explained by student background characteristics like the ones mentioned above (Opdenakker & van Damme, 2006; Sirin, 2005). *Thus, these variables are not only treated as student level factors but also highlight the importance of investigating school effectiveness in terms of the equity dimension.* For example, the evaluation of any policy promoting equal

opportunities could be based on investigating its impact on promoting educational progress of socially disadvantaged students and on reducing unjustifiable differences at the school level (Lamb, 1996).

Additionally, it is important to acknowledge that at the level of the classroom, students should be treated as individuals rather than as representing stereotypical groupings, so that the promotion of learning for all students is encouraged. However, at the level of the school or the system, if groups of students are systematically being disadvantaged in their rate of learning in comparison to other groups, as some effectiveness studies in different countries have shown (Beaton et al., 1996; Gorard et al., 2001; Gray et al., 2004; Harskamp, 1988; Kelly, 2012; Kyriakides, 2004; Strand, 2010), interventions for promoting equity both at the school and the system level should be developed.

- ***Background variables that emerged from the psychological perspective of EER***

The dynamic model also refers to five background variables emerged from the psychological perspective of EER which were found to be related with student achievement: aptitude, motivation, expectations, personality, and thinking style (e.g., Bamburg, 1994; Bandura, 1989, 1997; Marsh et al., 2007; Pajares, 1999). Aptitude, for example, is seen as one of the most critical background variables associated with student achievement. Aptitude embraces general intelligence and prior learning and is one of the best predictors of performance. Similarly, motivation and expectations were found to be related with student achievement and are very important in projects/studies attempting to improve the quality and equity of education (Baumert & Demmerich, 2001; Kuyper et al., 2011; Wehrens et al., 2010).

When referring to 'motivation', perseverance and subject motivation, are included since those concepts were found to be related with student achievement gains. It is taken into account that subject motivation may also be related to students' perceptions about the teacher who is offering the subject. Moreover, teacher behaviour in the classroom is likely to influence positively or negatively subject motivation (Baumert & Demmerich, 2001). Expectations can be measured by asking students to indicate the extent to which they believe that it is important to do well in the subject under consideration. The expectations that students believe that significant others (e.g., parents and friends) have for them could also be taken into account. This could be seen as a kind of external pressure that significant others may impose on students, in their perceptions. Given that there are individual differences in respect to prior achievement, teachers should be aware that this factor implies that they should hold different types of expectations from each student. Moreover,

the concept of expectations should be seen as a dynamic in nature. For example, as soon as a student makes progress his/her expectations may become higher. At the same time the demands of a series of lessons may induce different types of expectations to different students. It is therefore important to make sure that realistic expectation for and by each student should be generated. Realistic expectations could also include higher expectations for the disadvantaged students, since their parents might expect less from them. This can be seen as part of the contribution of the school to raise the self-esteem of those students and to show them that they are able to succeed.

Finally, personality characteristics of students (i.e., personality traits and thinking styles) have been a particular area of focus in the field of EER since effectiveness studies have highlighted these variables as predictors of student achievement (Kyriakides, 2005a, 2007). Personality traits may be taken as the different modes of relating with the environment. Many scholars (e.g., Goldberg, 1993; Taylor & MacDonald, 1999) have argued that the Big Five personality traits model accounts for a large amount of the variability in personality. According to this model, the factors of personality are as follows: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. Extraverts are sociable, active, and uninhibited, as contrasted to introverts, who are withdrawn, shy, and inhibited. Agreeable individuals are soft-hearted, generous, forgiving, and warm as contrasted to individuals' low in agreeableness, who are suspicious, headstrong, argumentative, and aggressive. Conscientious individuals are organised, energetic, and reliable as contrasted to individuals' low in conscientiousness, who are lazy, careless, and immature. Neurotic individuals are nervous, anxious, tense, and self-centred as contrasted to individuals' low in neuroticism, who are emotionally stable, alert, and content. Finally, individuals who are open to experience are curious, original, imaginative, and have wide interests, whereas individuals who are not open to experience are conservative and cautious.

The factors of personality have been linked to ways of adapting teaching and assessment approaches to the needs of specific groups of students. For example, teachers may find out that some students managed to perform better in a written test than during the normal teaching lessons and may attribute this result to cheating. However, these students may be introverted and consequently not like to express their ideas publicly and this is not because they don't have something to say but due to the fact that they tend to be shy, and inhibited. In such case, teachers may consider the possibility to address those students to answer a question or express their ideas even if they did not call for attention.

As far as the importance of treating measures of thinking style as a predictor of student achievement is concerned, it is important to note that in the search for variables that contribute to school achievement, psychologists have devoted considerable attention to the so-called stylistic aspects of cognition. The idea of a style reflecting a person's typical or habitual mode of problem solving, thinking, perceiving, and remembering was initially introduced by Allport (1937). There are at least three reasons for not only treating personality traits, but also styles associated with the theory of mental self-government (Sternberg, 1988), as student level factors. First, there are many studies which reveal that measures of thinking styles associated with this theory explain individual differences in performance not attributable to abilities (e.g., Grigorenko & Sternberg, 1997). Second, it has been shown that the thinking styles and personality overlap is limited (Messick, 1996; Sternberg, 1994; Zhang, 2002). This implies that not only intelligence and personality traits, but also thinking styles, should be taken into account in order to explain differences in student achievement. Third, according to the theory of mental self-government, thinking styles are seen as processes, which can be built on and used to compensate for or to remediate weaknesses. In this interpretation, styles are seen as dynamic. Therefore, teachers are expected to help students find or develop 'optimal' styles for particular situations in order to improve their achievement. Thus, the student-level factor concerned with the thinking style of students belongs to the category of the factors which change over time, and an important aim of education is to help students develop 'optimal' styles for particular situations.

- ***Variables related to specific learning tasks emerged from the psychological perspective of EER***

Time on task (time students are really involved in learning tasks)

The variable time on task refers to the time students are willing to spend on learning and on educational tasks. It is determined not only by motivation and expectations, but also by the time provided by the school/teacher and by processes at the school and classroom levels. It is important to note that time on task refers to the time in which students are really involved in learning (provided that this time is filled with opportunities to learn). Therefore, there are several reasons that, in the dynamic model, the variables *time on task* and *opportunity to learn* belong in the same category. An obvious reason is concerned with the fact that both variables refer to specific learning tasks that define the criteria for measuring effectiveness. In addition, these variables belong to the same category because they are not only determined by student background factors but also influence learning

directly. Elements of education at the classroom level, such as the ability of teacher to manage the classroom time, can contribute to an increase in time on task (assuming they are effective) (Kumar, 1991).

Opportunity to learn

The variable *opportunity to learn* refers to the fact that in order to achieve educational outcomes, students should at least have some opportunity to acquire knowledge and skills (Creemers, 1994). Providing learning opportunities for students is a very important aspect to offer equal educational opportunities and to promote simultaneously quality in learning. The development of this aspect gives the opportunity to students who are unable to be engaged in educational activities in their home learning environment (e.g. students with low SES), to enrich their knowledge by reducing the differences that they have with students with high performance. Higher socio-economic families can allocate more time and resources to provide quality learning time to their children outside the school day (Field et al., 2007). In contrast, disadvantaged students may not have parents or other adults around them with sufficient resources, whether in terms of time, attention, educational level or finance to support their learning after school. This, in result, increases inequalities in terms of the opportunity to learn and educational outcomes. Some international studies (e.g., de Jong et al., 2004; Isac et al., 2011; Kyriakides, 2005b; Kyriakides et al., 2000) suggest that time spent doing homework and time spent on private tuition could also be seen as measures of the 'opportunity to learn' factor. These measures of the opportunity factor were also found to be closely related with student achievement (e.g., Trautwein et al., 2002). However, it has to be acknowledged that the amount of time students spent voluntarily on specific learning tasks (e.g., mathematics, music, physical education) may not only be seen as a measure of opportunity to learn but may also be an indicator of students' interests and motivation about the subject associated with these tasks. Spending additional time on private tuition or on homework does not necessarily mean that the students make use of this extra time for learning purposes (Kyriakides & Tsangaridou, 2008). Therefore, a distinction is made between learning opportunities offered in the instructional process during and/or after the school time and the actual use of these opportunities that each student makes.

The Impact of School Level Factors on Student Achievement

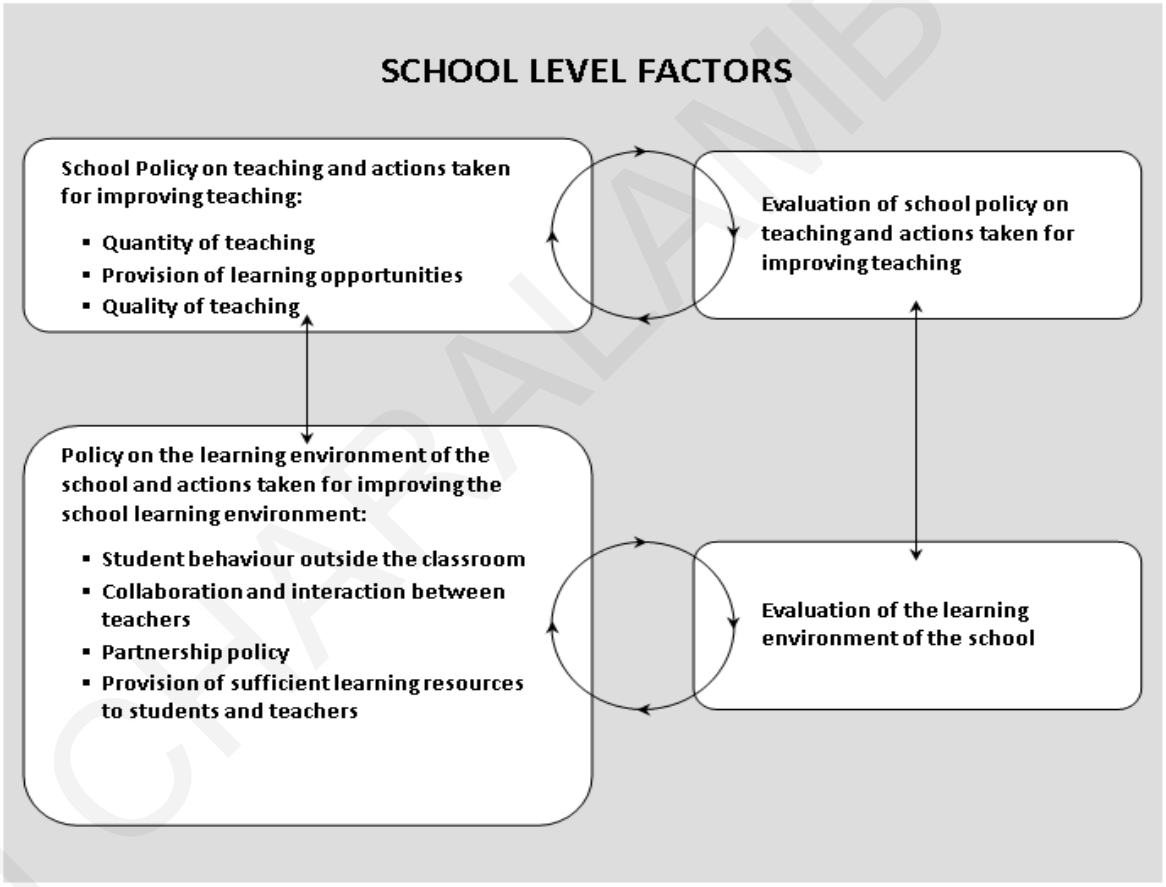
Factors at the school level are expected to influence classroom-level factors, particularly teaching practice. Since learning takes place both inside and outside the classroom, the dynamic model emphasises not only on how to improve teaching but also the School Learning Environment (SLE). As a consequence, the model refers to the: 1) school policy for teaching, and 2) school policy for creating a learning environment at school. Based on the assumption that the essence of a successful organisation in the modern world is the search for improvement (Hopkins, 2001), the processes and the activities which take place in the school in order to improve the teaching practice and the SLE are also examined. For this reason, the processes which are used to evaluate the school policy for teaching and the SLE are investigated. Thus, the following four factors at the school level are included in the model (see Figure 2.4):

1. *School policy for teaching and actions taken for improving teaching practice*
2. *Policy for creating the SLE and actions taken for improving the SLE*
3. *Evaluation of school policy for teaching and of actions taken to improve teaching*
4. *Evaluation of the SLE*

It is important to explain that the term "school policy" does not refer to one particular policy necessarily, but to the collection of school policies that focus on particular subjects and/or pedagogical practices in the schools. In order to explain concisely how and under what conditions school policy may have an impact on student achievement, a framework is presented (Kyriakides, Creemers et al., 2015) containing the main assumptions of this impact (see Figure 2.5).

Figure 2.4

Factors of the Dynamic Model Operating at the School level {Adopted from Creemers and Kyriakides (2008)}



The first assumption, which is supported by various effectiveness studies (see Reynolds et al., 2014) posits that there are many factors associated with student achievement which operate at four different levels: the student, classroom, school, and system levels. Second, the framework places emphasis on the school policy and actions taken to improve teaching and on the school policy and actions taken to improve the SLE.

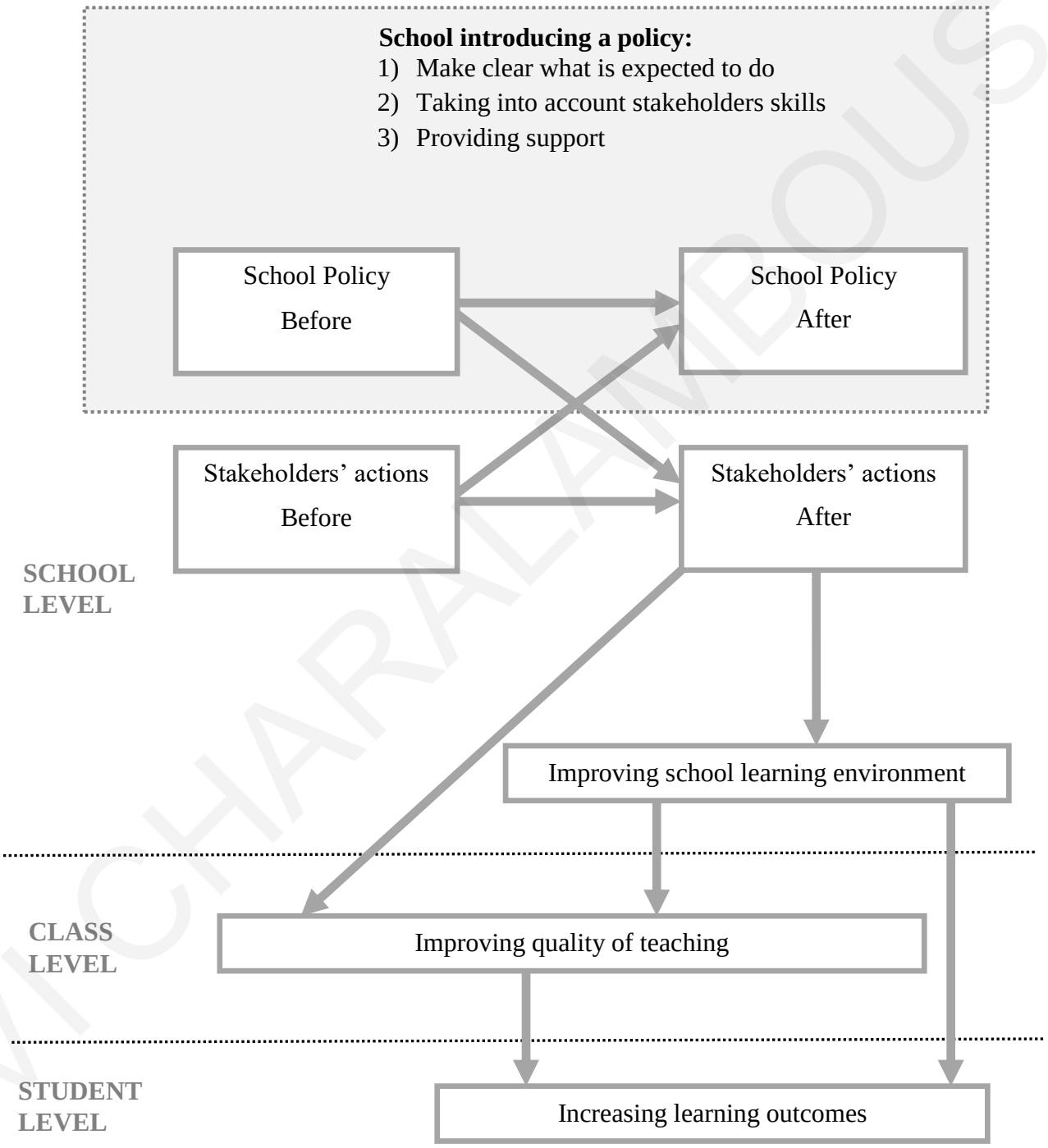
Third, the framework assumes that the impact of school policy depends on the extent to which stakeholders implement the policy guidelines. This is based on research suggesting that viewing implementation failure as a result of poor policy clarity neglects the complexity of human-sense making processes consequential to implementation (Spillane, 2005). For example, a school may develop a clear policy on partnership, which includes the involvement of parents in teaching. However, not all teachers may be persuaded to implement this policy, especially if they believe that parental involvement may jeopardize their professional autonomy. This implies that stakeholders' actions may have a direct impact on improving the SLE and teaching practice, whereas school policy may have an indirect impact by changing stakeholders' actions.

Fourth, it is assumed that there is a reciprocal relationship between school policy and school stakeholders' actions. Changes in school policy may have an impact on changing the actions of school stakeholders. At the same time, it is also possible that the stakeholders' actions might influence school policies by stressing the need to change the policy or policies in order to address current stakeholders' needs. To illustrate this reciprocal relationship, an example is given regarding student absenteeism. A new school leadership team appointed in a school with student absenteeism problems might develop a policy on student absenteeism to ensure that it is minimized. This move indicates the direct impact that a change in policy might have on changing stakeholders' actions. In contrast, in schools where the greatest majority of students regularly attend school, there is no need to develop such a policy. This illustrates the effect of the stakeholders' actions on setting or changing school policies.

Finally, the framework assumes that school policy has a situational effect on student achievement implying that its impact may vary depending on the current situation of the school under investigation. This situational character of school policy suggests that, in developing the school policy, school leaders should take into account the *abilities and readiness* of those who are expected to implement it. For example, take a school that originally had no minority ethnic students from a particular country and had to teach a Geography lesson on that country mainly by using secondary sources of information (e.g., books, internet). When students from that country join the student population, the school could for example invite the parents of these students to talk about their country.

Figure 2.5

A Theoretical Framework Investigating the Impact of School Policy on Teaching and School Policy for SLE on Student Learning Outcomes {Adopted from Kyriakides, Creemers et al. (2015)}



Three elements of school policy are considered. First, it is expected that school policy should *clarify all stakeholders' role* in improving learning. When the school policy is clear, the stakeholders are more likely to judge its recommendations and decide whether it is worth making the effort to change their actions. Guidelines are seen as one of the main indications of school policy. In using the term guidelines, the dynamic model refers to a range of documents. These include: staff meeting minutes, announcements, and action plans. These make the policy of the school more concrete to school stakeholders. However, this factor does not imply that each school should simply develop formal documents to install policy. The factors concerned with the school policy mainly refer to the actions taken by the school to help teachers and other stakeholders have *a clear understanding* of what is expected from them to do. Second, the framework assumes that in introducing a school policy, the *skills and the willingness of school stakeholders* should be taken into account. If a certain policy expects stakeholders to undertake roles they do not have the skills to perform or they are strongly opposed to, it is unlikely that the policy will be implemented effectively. The third element of school policy is concerned with the *support* that the school management team should provide for stakeholders to help them change their actions. Introducing a policy on teaching and/or the SLE that addresses these three elements is likely to influence stakeholders' actions. Below, the elements of the school factors are presented in detail to clarify the concepts upon which school stakeholders' actions should be based.

1. School policy for teaching and actions taken for improving teaching

The definition of the dynamic model at the classroom level refers to factors related to the key concepts of *quality*, *time on task*, and *opportunity to learn* (Creemers & Kyriakides, 2008). Therefore, the model attempts to investigate aspects of school policy for teaching associated with a) the quantity of teaching, b) provision of learning opportunities, and c) quality of teaching. Actions taken for improving the above three aspects of teaching, such as the provision of support to teachers in improving their teaching skills, are also taken into account.

- *Policy on quantity of teaching*

The following aspects of school policy on quantity of teaching are taken into account:

- School policy on the management of teaching time (e.g., lessons start on time and finish on time; there are no interruptions of lessons for staff meetings and/or for preparation of school festivals and other events)
- Policy on student and teacher absenteeism
- Policy on homework
- Policy on lesson scheduling and timetable

- *Policy on provision of learning opportunities*

School policy on provision of learning opportunities is measured by looking at the extent to which the school has a mission concerning the provision of learning opportunities beyond those included in the formal curriculum. Therefore, school policy on long-term and short-term planning and school policy on providing support to students with special needs is examined. Furthermore, the extent to which the school attempts to make good use of school trips and other extra-curricular activities for teaching/learning purposes is investigated.

- *Policy on quality of teaching*

School leaders are expected to encourage teachers to discuss the characteristics of effective teaching. By drawing on teachers' views and on the literature on effective teaching, guidelines on effective teacher behaviour in the classroom are expected to be produced, resulting in a school policy for teaching. Since the dynamic model refers to specific teacher factors found to be associated with student achievement (*orientation, structuring, questioning, teaching-modelling, applications, time management, teacher role in making classroom a learning environment, and classroom assessment*), it is expected that policy on the quality of teaching will refer to these eight factors measuring teacher behaviour in the classroom and consequently, the school management team should identify ways to support teachers improve their teaching skills accordingly.

These eight factors were found to be associated with student achievement gains (Kyriakides & Creemers, 2009). For example, if a teacher has not developed his/her time management skills or does not handle misbehaviour and disorder effectively, then he/she will face disciplinary problems in the classroom and teaching time will resultantly be reduced. In contrast, if the teacher creates a business-like and supportive environment for learning, misbehaviour may become a rare occurrence and teaching aims are more likely to be achieved. Therefore, effective schools are those which develop clear, specific and concrete policy on the quality of teaching, whilst encouraging teachers to create the

appropriate positive conditions for learning and instruction in the classroom. In addition, teachers who are effective in classes with students with different background characteristics (such as SES, ethnicity, initial achievement) differentiate their teaching since the use of a generalized approach for all students cannot have the same effect on the progress of a student with low SES and on the progress of a student with high SES (Brophy, 1992; Creemers & Kyriakides, 2006; Maden, 2001; Mortimore, 1999).

Consequently, the way school policy for teaching is examined reveals that effective schools take decisions on maximising the use of teaching time and the learning opportunities offered to their students. In addition, effective schools support their teachers in their attempt to help students learn by using effective teaching practices (Hallinger & Heck, 2011; Heck & Moriyama, 2010). In this context, the definition of this factor implies that the school management team attempts to ensure that:

i. Appropriate and adequate teaching time is provided for students.
ii. Students are provided with learning opportunities beyond those offered by the official curricula.
iii. Teachers take actions to improve the quality of their teaching

2. School policy for creating the SLE and actions taken for improving the SLE

Since learning does not only take place inside classrooms, the impact of the school policy for improving the SLE is explored. The dynamic model refers to the extent to which a learning environment has been created in the school and therefore, the focus is given on policy initiatives which aim to improve stakeholders' learning, and through that student learning. This is accomplished by concentrating on the following four school factors concerned with policy for improving SLE:

- *Student behaviour outside the classroom*
- *Collaboration and interaction between teachers*
- *Partnership policy (i.e., relations of school with community, parents, and advisors)*
- *Provision of sufficient learning resources to students and teachers*

The first three aspects refer to the practices which the school has developed for establishing a learning environment inside and outside the classroom. Here the term *learning* does not refer exclusively to student learning. For example, collaboration and interaction between teachers may contribute to their professional development (i.e., learning of teachers) but may also have an effect on teaching practice and thereby may also improve student learning. The fourth aspect refers to the policy on providing resources for learning. The availability of learning resources in schools may not only have an effect on

student learning, but may also encourage the learning of teachers. For example, the availability of computers and software for teaching Geometry may contribute to teacher professional development as it encourages teachers to find ways to make good use of the software in their teaching.

Actions taken for improving the SLE beyond the establishment of policy guidelines are also taken into account. Specifically, actions taken for improving the SLE can be directed at changing the school rules and providing educational resources (e.g., teaching aids and educational assistance). For example, a school may have a policy for promoting teacher professional development. However, this might not be enough, especially if some teachers do not consider professional development to be an important issue. In this case, actions may be taken to help teachers develop positive attitudes towards learning, which may help them become more effective.

Meta-analysis of studies searching for the impact of school factors (e.g., Hattie, 2009; Kyriakides et al., 2010; Scheerens et al., 2005) show that school qualities have causal effects on pupil progress, with variations in schools appearing to affect student achievement. The SLE is one of the main factors that have been examined. It is argued that teachers should know the crucial elements in learning environments that help and support students who are learning to manage and monitor their own processes of knowledge building and skill acquisition (Boekaerts et al., 2000; Thapa et al., 2013). It has also been emphasised that the environment at the school level can influence the behaviour of teachers and students and their consequent success in teaching and in learning (Hogrebe & Tate, 2010; Hughes, 1991). While evidence can be found that schools with favourable environments are academically more successful with students, no study investigating the impact of SLE on the equity dimension of school effectiveness can be identified.

3. School evaluation

The dynamic model also refers to the mechanisms used to evaluate school policy for teaching and the policy for creating the SLE (Creemers & Kyriakides, 2012). The following paragraphs aim to clarify how school evaluation is examined by taking into account the five measurement dimensions of the dynamic model described above.

Frequency: Frequency is measured by exploring how many times during the school year (if at all) the school collects evaluative data concerning its own policy for teaching or its own policy for the SLE. Emphasis is also given to the sources of data that are used. Studies have shown that effective schools use various sources for collecting evaluative data on teacher and school effectiveness, and that this data is collected periodically during the

school year, not only at the beginning and at the end of the school year (Beerens, 2000; Danielson & McGreal, 2000).

Focus: Evaluation and reflection on school policy may attempt to measure the properties of the school policy (e.g., clear, concrete, in line with the research literature), its relevance to the problems which teachers and students have to face, and its impact on school practice and student outcomes. It also considers whether each school evaluates not only the content of the policy for teaching and the actions taken to improve teaching practice but also the knowledge/understanding and readiness of those who are expected to implement the policy. Moreover, the focus dimension is measured by looking at the extent to which information gathered from the evaluation is too specific or too general. Research on school self-evaluation reveals that data collected should not be too specific or place blame on any individual (e.g., Fitz-Gibbon, 1996; Hopkins, 2001; Visscher & Coe, 2002) because such an approach serves the summative purpose of evaluation and does not help the schools to take decisions on how to improve their policy. At the same time, information gathered from evaluation should not be too general but should be focused on how to influence decision-making. In particular, the process of allocating responsibilities to school partners in order to introduce a plan for improving the effectiveness of their school is essential (Kyriakides & Campbell, 2004; MacBeath, 1999; Meuret & Morlaix, 2003).

Stage: The stage dimension is examined by looking at the period in which evaluative data are collected. More effective schools are those which conduct evaluation regularly and systematically (i.e. not just at the end of school year); they establish evaluation mechanisms which operate on a continuous basis during the whole school year. More effective schools are also those that review their own methods and systems of reflection and evaluation adapting them in order to collect appropriate and useful data (Cousins & Earl, 1992; Torres & Preskill, 2001).

Quality: Quality is measured by looking at the psychometric properties (i.e., reliability, validity and use) of the instruments schools use to collect data. It also is expected that evaluation data will be used for formative rather than summative reasons, as school evaluation is seen as closely related to the school improvement process (Hopkins, 1989; Kyriakides, 2005a).

Differentiation: Finally, the differentiation dimension is measured by looking at the extent to which the school places a greater emphasis on conducting evaluation for specific aspects/reasons of the policy for teaching. This is especially relevant to those aspects which refer to the major weaknesses of the school. For example, if policy on homework is considered problematic the school may decide to collect data related to homework

practices more often and in greater depth instead of collecting data for any other aspect of school policy for teaching.

Summing up, all the above mentioned school factors are not only important in promoting quality but also in promoting equity in education. The present study is interested in exploring if schools in disadvantaged contexts can simultaneously improve the quality of what they do as well as accomplish greater equity (reducing learning differences between students) through an intervention. At this point it is worth reminding that the dynamic model was established in order to create stronger relations between EER and improvement of practice. Research in the field (see Creemers & Kyriakides, 2010a) shows that this cannot be done only by using this model since schools and teachers need to firstly understand why the specific factors are important for improving their practices (Scheerens, 2013) and to secondly have available ways of improving the factors specified in the model, for example strategies and plans of how they can improve their students' learning outcomes. Therefore, this study is based on an intervention that makes use of the *Dynamic Approach to School Improvement (DASI).* This approach underlines the significance of collecting data about the functioning of factors at the classroom and school level to identify teacher and school improvement needs, correspondingly (Creemers & Kyriakides, 2015). Thus, in the final part of this chapter, the rationale, basic assumptions and main steps of DASI are concisely presented. DASI emphasises the need for collecting data on the functioning of the effectiveness factors of the dynamic model at the classroom and school level to identify teacher and school improvement necessities. Since a series of studies has provided support for the validity of the dynamic model (see Table 2.1 above) and DASI makes use of the theoretical framework of the model, it can be argued that an *evidence-based* and *theory-driven* approach to improvement can be gradually developed (Creemers & Kyriakides, 2012). At the end of the following part, studies investigating the impact of using DASI on promoting student learning outcomes (quality dimension) are also mentioned.

The Dynamic Approach to School Improvement (DASI)

Rationale and Assumptions

The DASI has been developed in order to help schools design their improvement plans by taking into account the recent theory and empirical evidence that demonstrate those effectiveness factors that they actually make an impact on students' leaning outcomes. By using the dynamic model of educational effectiveness, this approach focuses on the significance of improving school policy for teaching and the SLE since these two overarching factors were found to be associated with student learning outcomes (Hattie, 2009; Kyriakides et al., 2010; Scheerens et al., 2005).

One of the main assumption of DASI is that *school improvement efforts can have an impact on student achievement only when these are based on valid theories which have been methodically tested* (Bryk et al., 2010; Buczynski & Hansen, 2010; Mosteller & Boruch, 2002; Slavin, 2002). An effective improvement plan cannot be based only on the experiences of school stakeholders and on their ideas of changing things in their school, since the creation of only a friendly school climate does not guarantee the improvement of students' learning outcomes. Hence, as mentioned above, DASI has its own theoretical framework, which refers to school factors of educational effectiveness that were found to be related with student learning outcomes (cognitive and affective).

Second, DASI is based on the assumption that *student learning should be considered as the central purpose of any school improvement effort* (Creemers & Kyriakides, 2015). If learning outcomes are not improved, any school improvement effort cannot be considered fruitful no matter how much it may manage to improve the school climate or any other school factor. For this reason, clarifications about the purpose of the improvement plan should be made to all school stakeholders from the very beginning and a summative evaluation should be always carried out at the end of the intervention.

Third, DASI is based on the fact that the school factors of the dynamic model can be improved and through that improvement, the school could increase student achievement. It is, therefore, expected that schools should *establish clarity not only about the central purpose of any improvement effort but also about its transitional goals which should be concerned with the improvement of the functioning of the school factors that are associated with student learning outcomes.*

Fourth, DASI emphasises *the presence of an A&RTeam in any school improvement effort* (Creemers & Kyriakides, 2012). Each school can develop its own strategy plan for improvement, but support should be offered by an A&RTeam which is able to provide

technical expertise and the available knowledge-base on improving the factors addressed by the school. Consequently, school stakeholders are not left alone to design and implement their actions plans, but are encouraged to make use of this expert team. As a result, a systematic research-based approach to design, implement, and evaluate every improvement effort (Bryk et al., 2010; Rowan et al., 2009), is promoted by DASI.

Fifth, DASI adopts the idea that each school should develop its own strategies and action plans for improvement by not only taking into account the knowledge base of the dynamic model, but also by *taking into consideration the professional needs and abilities of all school stakeholders (teachers, students, parents).* This means that DASI can be adjusted in many different school contexts (Heck & Moriyama, 2010; Hofman et al., 2010).

Sixth, taking into account the fourth and fifth assumptions above, *cooperation between the school stakeholders and the A&RTeam* in designing and implementing an improvement plan is essential for a successful intervention and for accomplishing *ownership*. This implies that DASI stimulates a special approach to improvement where each party has a specific role and expertise that brings to the intervention. In this way, problems that may arise in conducting experimental studies where practitioners see themselves as those who are expected to follow in a rather strict way an intervention which was designed by others, are avoided (Cheng, 1996; Coe, 2009). Moreover, many interventions that were found to have an impact when they were implemented under the management of a research team which follows a strict experimental approach may have no effect when school stakeholders are left alone to implement their action plans (Creemers & Kyriakides, 2015). The relationship established between the school and the A&RTeam, reveals the main difference of DASI from other school improvement approaches that give emphasis only to the professional experience of school stakeholders and not to the available knowledge emerged from educational effectiveness studies or the opposite (Creemers & Kyriakides, 2012).

Seventh, "effective schooling is seen as a dynamic, ongoing process" (Creemers & Kyriakides, 2015, p. 106) in DASI. Therefore, *every school (effective or least effective) should be able to adapt to the new educational concepts and be willing to continue its efforts for improvement* (contingency theory; Donaldson, 2001) in relation to its policy for teaching and policy for creating a SLE. By doing this, the effective school could remain effective and the least effective could increase their students' achievement (Creemers & Kyriakides, 2010b).

Lastly, since DASI is concerned with identifying ways of improving the strategies and action plans during the implementation and with measuring the impact of the intervention on student learning outcomes, *formative and summative evaluation mechanisms are established respectively* (Creemers & Kyriakides, 2012). Specifically, at the beginning of the school year, all schools are expected to generate data (qualitative and quantitative) to find out how to improve the functioning of the school factors and through that to promote student learning. School stakeholders and the A&RTeam are expected to develop mechanisms for monitoring the implementation of the intervention (formative evaluation) to further develop the school improvement strategies and action plans. Finally, the A&RTeam and the school stakeholders are expected to measure the impact of DASI on promoting student learning outcomes (quality) and reducing the achievement differences between students (equity) at the end of the intervention (summative evaluation).

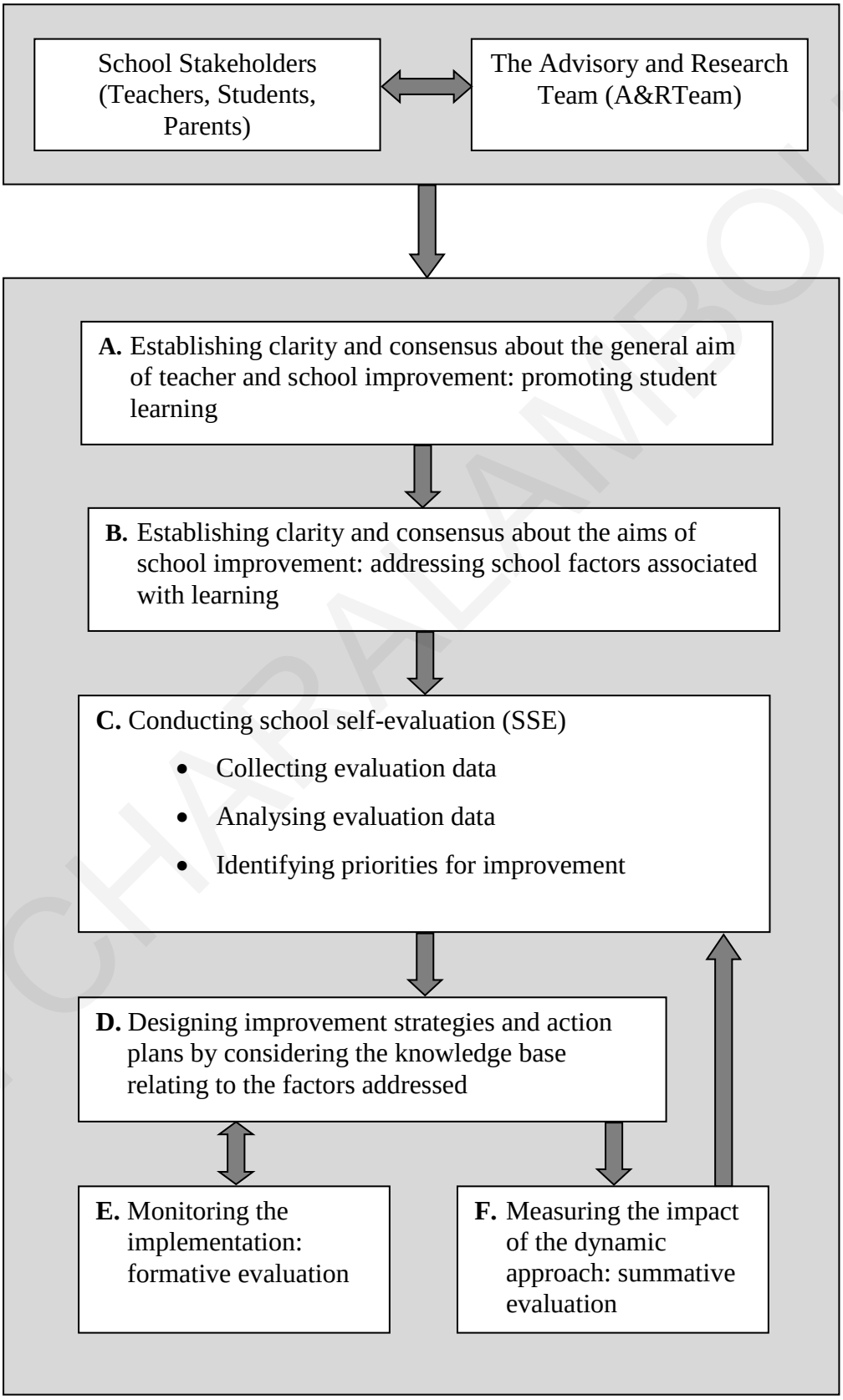
The Major Steps of DASI

Figure 2.6 illustrates the main steps of DASI (Creemers & Kyriakides, 2012). It highlights the fact that school stakeholders and the A&RTeam are expected to be actively involved in each step of DASI. Their ability to work together and exchange abilities, knowledge and experiences is critical for the success of any school improvement project. While the main purpose of this study is to implement an improvement plan for promoting both quality and equity in schools, it is essential that each step of this approach is followed.

Step A: Establishing clarity and consensus about the general aim of school improvement by considering student learning as the main function of the school. It is important to start with a clear understanding of the aim of the project and how improvement in quality and equity of education will be achieved. The first step of this approach is based on the second assumption (see above) and establishes procedures to ensure clear understanding among all school stakeholders about the ultimate aim of school improvement. This study is based on the premise that school improvement is centred on the promotion of student learning (quality) and the reduction of differences in student learning outcomes between students coming from different sociocultural backgrounds (equity). Even if school stakeholders have different insights about what can be done for improving their effectiveness and it is difficult to reach consensus among all participants (Fullan, 2001), it is crucial at this first step to commit the interested parties into collaborative work and explain to them that every effort for improvement has to do with student learning outcomes (Chapman & Fullan, 2007).

Figure 2.6

The Major Steps in the Dynamic Approach to School Improvement {Adopted from Creemers and Kyriakides (2012)}



Step B: Establishing clarity and consensus about the aims of school improvement by addressing school factors which influence teaching and learning. The dynamic model and its factors are presented to the school stakeholders. This presentation is based on the third assumption of DASI presented above and helps teachers understand how and why by addressing the school factors student learning can be promoted. Specifically, the model may assist school stakeholders to define not only the ultimate aim of the school improvement effort, which should be concerned with the improvement of learning outcomes, but also its intermediate objectives which may contribute in the achievement of aims associated with the challenges that they are facing (e.g. school drop-out, bullying).

Step C: Collecting evaluation data and identifying priorities for improvement. The collection of the evaluation data is undertaken jointly by the A&RTeam and the school stakeholders. The research team afterwards proceeds in analysing the data and helps school stakeholders identify their priorities for improvement. The improvement areas are then announced to the whole school community and suggestions are given in order to define the specific area/areas of improvement. This step highlights the importance of using an evidence-based approach for school improvement.

Step D: Designing school improvement strategies and action plans by considering the available knowledge base concerning the factor(s) to be addressed. This step is one of the most important steps of DASI. Members of the research team share their expertise with school stakeholders providing additional input to existing ideas, experiences and knowledge in order to help schools develop their own strategies and action plans. Whilst the research team is expected to provide suggestions for school stakeholders, which are based on research evidence, it is the schools themselves that should decide on the content of their action plans, having considered their evaluation data (see Step C), needs and abilities (Hofman et al., 2010). In developing action plans it is important to specify which tasks need to be undertaken, who is going to be responsible for implementing each task, when each task is expected to be implemented and which resources should be provided for the stakeholders to implement these tasks. A template of an action plan that could be used at this stage is provided in Appendix F. A handbook indicating specific actions that could be taken to improve the functioning of each school factor in relation to their improvement priorities should be also provided by the A&RTeam.

Step E: Monitoring the implementation of the improvement project by establishing formative evaluation mechanisms. School stakeholders should not only develop strategies and action plans, but should also establish formative evaluation

mechanisms in order to be able to take decisions on how to improve these action plans. According to the dynamic model, school evaluation is one of the overarching school factors which implies that a constant model of school evaluation will permit schools to adjust their policy decisions based on the needs of different groups of school stakeholders (see Creemers & Kyriakides, 2010b). Both school stakeholders and the research team are involved in conducting formative evaluation. In addition, an internal school evaluation mechanism should be developed where school stakeholders may reflect upon their abilities not just to implement the action plans, but also to improve the functioning of school factors (Kyriakides & Campbell, 2004). As a result of establishing formative evaluation mechanisms and collecting data, school stakeholders can identify weaknesses in their action plans and take specific measures to improve them. Thus DASI supports the idea that a developmental evaluation strategy may contribute to the improvement of the effectiveness status of schools, which has been supported by substantial research evidence (e.g., Gray et al., 1999; Shaw & Replogle, 1996).

Step F: Measuring the impact of DASI. Finally, the A&RTeam and the school stakeholders should develop summative evaluation mechanisms in order to measure the impact of DASI on promoting student learning. This step may also reveal the importance of identifying a new priority area for improvement. If summative evaluation reveals that a school has managed to substantially improve the functioning of the factor(s) addressed, school stakeholders and the A&RTeam may decide to collect new evaluation data and identify a new priority improvement area. By conducting school evaluation (moving back to Step C) the new priority area is identified and a new improvement project is developed and implemented. Improvement efforts in DASI are seen as continuous, cyclical in nature, and embedded in a wider process of the overall school development (Nevo, 1995; Scheerens et al., 2003). In order to conduct a summative evaluation, school stakeholders with the support of the A&RTeam should collect comparable data with those that emerge from step C, and evaluate their interventions by following a value-added approach. At this step the A&RTeam has a vital role, as it has relevant skills and can design the summative evaluation, as well as analyse quantitative data using the appropriate advanced statistical techniques (Creemers et al., 2010). The validity of the instruments and the reliability of the measures are examined by the A&RTeam and the impact of DASI on student learning outcomes is explored. Although the results of the analysis of the data should be obtained, the A&RTeam has to find simpler ways to announce these results showing not all of the statistical figures that emerge from the advanced quantitative analyses but only those that are understandable by the school stakeholders. It can be argued, therefore, that Figure 2.6

shows that more effective schools always search for improving their effectiveness status irrespective of how effective they are (in line with the seventh assumption mentioned above).

The Impact of DASI on Promoting Quality in Education

During the last ten years, four experimental studies have been conducted in order to identify the impact of DASI on promoting student learning outcomes (see Table 2.2). The first two studies (Antoniou & Kyriakides, 2011; Christoforidou et al., 2014) detailed in Table 2.2 are concerned with the use of DASI for improving *teacher effectiveness*. These studies have shown that DASI was more effective than either the Competency Based Approach (CBA) or the Holistic Approach (HA) to teacher professional development which are considered as the two dominant approaches to teacher professional development internationally (see Creemers et al., 2013). Teachers employing DASI managed to improve their teaching skills substantially and, as a result, improve the learning outcomes of their students. The other two studies were concerned with the use of DASI at *school level* and demonstrate the added value of using DASI to promote student learning outcomes. Specifically, the third study was concerned with the attempt of schools to establish self-evaluation mechanisms for improvement purposes (Demetriou & Kyriakides, 2012). DASI was found to have stronger impact on student achievement gains in mathematics than the participatory approach. The fourth study took place in five European countries (i.e. Belgium, Cyprus, England, Greece, and the Netherlands) and was concerned with the use of DASI for reducing bullying (Kyriakides et al., 2014). Schools which made use of DASI were able not only to improve the functioning of school factors but also to reduce bullying at a significantly higher level than the schools of the control group.

Table 2.2

Experimental Studies Investigating the Impact of Using DASI rather than Participatory Approaches that are Based on Practitioner's Expertise and Effects on Student Learning Outcomes

Area of Investigation	Impact on Factors	Ultimate Aims
1. Using DASI rather than HA to offer INSET to primary teachers (n=130)	Only teachers employing DASI managed to improve their teaching skills	DASI had an impact on student achievement
2. Using DASI rather than CBA to offer INSET course on assessment (n=240)	DASI had a stronger impact than CBA on improving assessment skills of teachers at stages 2, 3 and 4	DASI had an impact on student achievement
3. Using DASI to establish school self-evaluation mechanisms in primary schools (n=60)	Not examined since schools had to deal with different improvement areas	DASI had an impact on student achievement
4. Integrating DASI with research on bullying to help schools (n=79) in five European countries to establish strategies to face and reduce bullying	DASI had an impact on school factors	DASI had an impact on reducing bullying

Studies:

1. The impact of a dynamic approach to professional development on teacher instruction and student learning: results from an experimental study (Antoniou & Kyriakides, 2011).
2. Searching for stages of teacher skills in assessment (Christoforidou et al., 2014).
3. The impact of school self-evaluation upon student achievement: a group randomisation study (Demetriou & Kyriakides, 2012).
4. Using the dynamic model of educational effectiveness to design strategies and actions to face bullying (Kyriakides et al., 2014).

In the aforesaid studies, schools were given guidelines on how to design strategies and actions to improve their effectiveness. Those actions were based on the school effectiveness factors of the dynamic model. Although these four studies provide some empirical support on the impact that DASI can have on student learning outcomes, ***participating schools were not situated in socially disadvantaged areas.*** Given that early effectiveness studies (Edmonds, 1979; Rutter et al., 1979) were concerned with identifying ways to help schools in socially disadvantaged areas to achieve learning outcomes, it is important to find out whether DASI can help these schools to become more effective.

Thus, the study reported here investigates the extent to which DASI can promote quality and equity in schools at socially disadvantaged areas.

In regard to the impact that DASI may have on promoting equity, it is emphasised that a framework to measure the functioning of school factors in relation to all five dimensions is used and the importance of treating differentiation as a separate dimension of measuring effectiveness factors is stressed. Adaptation to the specific needs of each subject or group of subjects increases the successful implementation of a factor and ultimately maximize its effect on student learning outcomes. For example, there is a debate on the impact that interventions on parental involvement may have on the equity dimension of effectiveness. There are studies which show that improving parental involvement in general may promote learning outcomes but not for students with less encouraging home learning environment and thereby may increase the impact of the SES on student learning outcomes (Feuerstein, 2000; Grolnick et al., 1997; Lareau, 1987). On the other hand, there are some other studies which show that projects aiming to improve parental involvement may be more effective for schools in socially disadvantaged areas and may contribute in reducing the impact of SES on student achievement (Christenson et al., 1992; Epstein, 1991; Singh et al., 1995). These opposing findings could be attributed to the importance of considering differentiation in developing and implementing school policy on partnership. Therefore, the present study takes place in socially disadvantaged schools and attempts to examine the impact that DASI may have not only on student achievement gains in mathematics (quality) but also on reducing the impact that SES can have on student achievement in mathematics (equity).

Chapter 3: Methodology

Chapter 3 presents the methodology that was used to investigate the impact of DASI on promoting student achievement in Mathematics and on reducing the effect of the students' SES on their Mathematics learning outcomes. In the first part of this chapter, the use of an experimental research design is justified and in the second part the research design of the study is explicitly described. Specifically, the preparation procedures of the study including the data collection and the construction and validation of the measurement instruments are defined. Next, the stages of the intervention in the main study are identified and the analysis of the data is described. Lastly, in the third part, the methodological limitations of the study are discussed.

Using an Experimental Study to Promote School Effectiveness in Terms of Quality and Equity: Justification of the Selected Research Method

As indicated in Chapter 1, the main aim of this study is to evaluate the impact of DASI on promoting student achievement in Mathematics and on reducing the effect of students' SES on their Mathematics learning outcomes. To achieve this aim, an experimental research is designed. According to Cohen et al. (2007), "the essential feature of experimental research is that investigators deliberately control and manipulate the conditions which determine the events in which they are interested, introduce an intervention and measure the difference that it makes." (p. 272). Since this study is implementing DASI as an intervention to schools so as to make an impact on the learning outcomes of students, it is essential to follow an experimental design rather than any other research method since *cause and effect relationships* are to be identified.

The topic of *causality* is rarely addressed explicitly in the field of education (Angrist, 2004), even though the main question that EER tries to answer is why and how some schools are more effective than other in terms of promoting better student learning outcomes (Creemers et al., 2010). Consequently, EER establishes and tests theories containing effectiveness factors that are associated with student achievement, by dealing in this way with causal relations. A *cause* could be any construct that makes any other variable change its functioning over a period of time and an *effect* could be a variable which is influenced by another construct (Locke, 1975). For example, the improvement of student outcomes (effect) is considered to be due to the functioning of a school factor like the parental involvement (cause). However, Holland (1986) argues that a cause can never be determined unequivocally and it is likely that some effects represent the result of

combinations of factors or interactions between them. This means that in the field of EER researchers try to identify the probability that particular effects will occur. Estimating *the likelihood* that an effect will occur gives the opportunity to explore why certain effects appear to occur in some situations but not in others. This is also in line with the statistical approaches used in EER models that normally identify the percentage of variance in outcomes that can be statistically explained or accounted for by different combinations of predictors (Creemers et al., 2010). This is very important for researchers whose aim is to improve practice through modelling variations in effectiveness over time and the factors that foresee such variation in student outcomes.

Also, according to Gustafsson (2013), the causal effect of an intervention is the difference in result for a specific individual when the individual is part of this intervention and when the individual is not part of this intervention. Nevertheless, since a researcher cannot observe a person under these two conditions simultaneously, he/she creates two groups of persons with similar characteristics and compare the results of the intervention for these two groups. The difference (e.g. in learning outcomes) between the mean of the experimental group and the control group is the casual effect of the intervention. The main issue here that a researcher should examine is whether the persons in the experimental group have the same characteristics as the ones in the control group. This can often be achieved by *randomisation* (Cohen et al., 2007) which means that a random assignment of participants to the two groups assures that differences between the groups can be attributed to the intervention effects rather than to their characteristics. Nevertheless, only a few experimental studies within the field of EER have been conducted to identify cause and effect relations between school factors and improvements in school effectiveness and students' results (Antoniou & Kyriakides, 2011; Demetriou & Kyriakides, 2012; Tymms & Merrell, 2009). Also, randomized experiments could only indicate whether there are 'intervention effects' and the scale of these effects; they do not provide explanations on why an intervention has an impact. This is the role of the theory behind the intervention. Accordingly, when there is a strong reason to believe that a specific approach will lead to better results, an experimental approach is necessary for detecting the effects of this approach/intervention (Creemers et al., 2010).

Taking all the above into consideration, since four experimental studies have used DASI and identified its impact on promoting student learning outcomes (see Chapter 2), there is strong evidence that this approach could be used in the present study by conducting an experimental research. Additionally, the dynamic model of educational effectiveness (Creemers & Kyriakides, 2008) which is the theoretical framework of this approach has

been empirically tested through national and international studies as well as by two meta-analyses of studies investigating the impact of teacher and school factors (see Chapter 2). These studies reveal that factors included in the dynamic model are associated with achievement gains in different learning domains of primary school students and therefore, cause and effect relationships could be also identified in this study. To sum up, the study's characteristics enable the design of an experimental research in which schools from the four European countries are randomly assigned into two groups to test the impact of DASI upon the experimental group. Detailed information on the sampling procedures and the intervention phases are given in the following part.

Research Design

This research involves three main phases: *preparation of the study*, *main study* and *analysis of the data*. During the preparation phase, which took place between September 2014 and October 2015, the measurement instruments were constructed and then validated (i.e. students Mathematics tests, teacher questionnaire, student questionnaire) and the sample of the study was selected. Also, the material (school guidelines) for implementing DASI in schools was developed. In the next school year (October 2015-June 2016) the main study took place. During this second phase, schools from socially disadvantaged areas in each participating country (n=72) were randomly assigned into the experimental (n=36) and control (n=36) groups. The initial measurement of students Mathematics knowledge of Grades 4, 5 and 6 as well as the measurement of the functioning of the school level factors of each school took place at the beginning of the school year 2015-2016. After that, the intervention to schools of the experimental group began by implementing DASI, whereas in schools of the control group feedback about the results that emerged from the pre-measure concerned with the functioning of their school factors was only provided and consequently schools were supported to develop their own strategies and actions to promote quality and equity without using DASI. At the end of the school year, final measurements of students' Mathematics knowledge took place as well as the measurement of the functioning of the school factors of each participating school. Moreover, a questionnaire was administered to all students of the sample for measuring their socioeconomic background. Finally, in the third phase of the study (July 2016 – January 2017), after entering the data from the pre- and post- measures, the validity and reliability of the collected data were tested and the analyses of data were conducted. In Table 3.1, the research design of this study is briefly presented and in the following sections of this part of the chapter, each phase is described in detail.

Table 3.1

The Research Design of the Study

Phases of the Study	Period / Months	Activities
A. Preparation of the study	September – November 2014	Construction of the teacher questionnaire.
	January – April 2015	Construction of the Mathematics tests of Grades 4, 5 and 6 (pre- and post- tests) and of the student questionnaire.
	May – June 2015	Validation study of the Mathematics tests.
	April – September 2015	Developing the material (handbook) for implementing DASI to schools.
	September 2015	Sample selection
	September 2015	Final version of the measurement instruments.
	October 2015	Final version of the handbook in English and Greek.
B. Main study – The intervention	October 2015	Random assignment of schools into the experimental and control groups.
	October 2015	Offering an external seminar to the head teachers of the schools of the experimental group based on the main steps of DASI.
	October – November 2015	Initial measurements of students' achievement in Mathematics and of the functioning of each school's policy.
	November 2015	Reports to each school of the experimental group based on the results of the teacher questionnaire and identification of their improvement areas. Control group schools received only the results of the teacher questionnaire.
	November – December 2015	Development of action plans in the experimental group schools by using the handbook.
	December 2015 – May 2016	Monitoring the implementation of the action plans – Providing feedback (experimental group schools)
	May – June 2016	Final measurements of students' achievement in Mathematics, of students' SES and of the functioning of each school's policy.

C. Analysis of the final data	July - September 2016	Entering the data from pre- and post-measures.
	September - October 2016	Testing the validity and reliability of the collected data.
	November 2016 – January 2017	Within-country analyses (measuring the impact of the implementation of DASI).

Preparation of the Study

Using a Teacher Questionnaire to Measure School Factors. In order to evaluate the effectiveness of the school level factors of each school, a *teacher questionnaire* was designed for measuring school policy for teaching and school policy for creating a learning environment by taking into account how these overarching factors are defined by the dynamic model of educational effectiveness (see Chapter 2). Specifically, the English version of a teacher questionnaire that was validated and used in previous effectiveness studies in Cyprus and in other European countries (e.g. Creemers & Kyriakides, 2010b; Vanlaar et al., 2016) was presented to the country teams during a meeting in Cyprus. This original instrument was systematically discussed by the members of each country team, who expressed their views on the applicability and relevance of each item to their educational context. As a result of this procedure a number of items were dropped from the original questionnaire and new items were added. The revised version of the teacher questionnaire consists of three parts. The first part of the questionnaire is concerned with the formation of the school policy and the learning environment of the school, whereas the second part comprises statements concerned with the evaluation of the school policy. In total, in the final version of the teacher questionnaire (see Appendix A) there are 105 items (=statements) in which teachers were asked to express their views by using a four-point Likert scale (1: strongly disagree….4: strongly agree) (Likert, 1932). Finally, in the third part of the questionnaire, personal data are gathered (e.g. gender, teaching position, years of teaching etc.). The questionnaire was designed in such a way that information about the five dimensions of the school-level factors of the dynamic model could be collected. A specification table (see Appendix B) was also produced to enable country teams report the results to each school. After the formation of the English version of the teacher questionnaire, the Cypriot and Greek research teams developed the Greek version of the

questionnaire and back translation was also carried out. The final version of the teacher questionnaire in both languages was ready until the end of September 2015.

Using Mathematics Tests to Measure Student Achievement. One of the main aims of this study is to evaluate the impact of DASI upon student achievement. To accomplish this, assessment instruments measuring basic skills in Mathematics were developed. Mathematics was selected because educational effectiveness studies reveal that the school effect in promoting cognitive learning outcomes in Mathematics is greater than for any other subject (see Chapman et al., 2016; Kyriakides et al., 2010; Scheerens, 2013). Moreover, practicality matters such as the translation of the tests and the time needed for correcting students' answers in Mathematics compared with other subjects were also taken into consideration. First, each country team (in collaboration with expert teachers and ministry officials) analysed its own Mathematics curricula and developed a specification table covering basic skills in Mathematics in each one of the four grades (3, 4, 5 and 6) (age groups 8 to 12 years old students). Comparisons between these tables were made to develop a common one that addresses aspects of numeracy covered by all four countries. Also, each country team collected instruments measuring the constructs mentioned in the common specification table. Then, the country teams compared the items and developed a battery of written tests in English. Specifically, the country teams developed the Mathematics tests for students of Grades 4, 5 and 6 for the initial and final measurements. The tests covered the following content categories: whole numbers; fractions and proportionality; measurement, estimation and number sense; data representation, analysis and probability; and geometry and patterns. Item (question) formats included: short answer questions (completion and fill in the blank) and problem-solving. Translations from English to Greek were then carried out by the Cypriot and Greek teams and back translation was followed to ensure translation into the Greek language was appropriate.

Summing up, *four Mathematics tests* were developed (*Grade 3 test*=beginning of Grade 4, *Grade 4 test*=end of Grade 4 and beginning of Grade 5, *Grade 5 test*=end of Grade 5 and beginning of Grade 6, *Grade 6 test*=end of Grade 6) until April 2015. Consequently, between May and June 2015, the face, content and construct validity of the four tests was tested. In detail, each country team collected data on the views of colleagues and consultants/inspectors on the extent to which the battery of tests covers the national Mathematics curricula of Grades 3-6 (content validity). Each country team also collected data on the views of teachers on the extent to which the test items are in line with their practices (e.g. context of the items, type of questions, difficulty level of the language used,

time given) and take into account the abilities of students to understand what they are expected to do (face validity). After that, the construct validity of the tests was examined. Specifically, each country team administered the tests to Grade 3, 4, 5 and 6 students (n=1882) in at least 4 schools in their country (see Table 3.2). The data were then analysed by using Item Response Theory (IRT) (Rasch model) (Hambleton & Swaminathan, 1985) to identify any problematic items. Some items were dropped and other items were slightly changed. Finally, in September 2015, the country teams developed the final version of the Mathematics tests (see Appendix C for the battery of the tests and Appendix D for the specification table of each test).

Table 3.2

Overview of the Sample of Students and Schools used in the Validation Study of the Mathematics Tests in each Country

Country	Number of Students					
	Grade 3	Grade 4	Grade 5	Grade 6	Total	Number of Schools
Cyprus	180	90	111	100	481	5
Greece	74	185	141	167	567	6
England	110	111	117	129	467	4
Ireland	104	96	85	82	367	4
Total	468	482	454	478	1882	19

Using a Student Questionnaire to Measure the Socioeconomic Background of the Students. To evaluate the impact of DASI on reducing the effect of the socioeconomic background of the students on their Mathematics learning outcomes, measurement of the students' socioeconomic background should also take place. Specifically, a student questionnaire for measuring SES was developed during the first phase of this study (April 2015). This questionnaire accompanied each one of the Mathematics tests administered at the end of the school year 2015-2016 (post measurement) and is filled by all students of Grades 4, 5 and 6 after the completion of their test. For developing the student questionnaire for this study, items from *TIMSS 2007 Background Student Questionnaire* (Olson et al., 2008) were used. Specifically, the questionnaire comprises seven questions about home resources, languages spoken in the home, nationality, parents'/guardians'

occupation and nationality and students' learning habits from outside of school (see Appendix E).

Designing Evidence-Based Strategies and Actions to Promote Quality and Equity in Schools. For addressing each improvement area specified from the teacher questionnaire and implementing DASI to schools, the country teams produced a *handbook* providing suggestions on action plans that could be developed in order to improve each aspect of school policy for teaching and each aspect of the SLE. This handbook explains to school stakeholders how the dynamic approach (see Chapter 2) can be used for meeting their improvement priorities. Specifically, during the months of April-September 2015, the school guidelines for designing school improvement strategies and action plans for promoting quality and equity were prepared by collecting material from all country teams and by conducting a comprehensive literature review of the available scientific papers and books in the field of EER. A draft version of the handbook (in English) was, therefore, produced and discussed in a meeting with all members of each country team. By taking into consideration the comments made on the handbook and the exchanging of experiences on good practices, its final version was produced by the beginning of October 2015 and translation into Greek was carried out by the Cypriot and Greek teams.

The produced handbook, presents the theoretical framework of the intervention and provides suggestions to schools on how to build school evaluation mechanisms that aim to improve educational practices at school level. The handbook also includes the rationale of the intervention and clarifies the role of the A&RTeam. It is made clear that the A&RTeam should provide support to school stakeholders in order to assist them in carefully setting up their own strategies and action plans for promoting not only quality but also equity. Thus, the aim of the handbook is mainly to help schools develop and implement their strategies and action plans, by providing concrete and specific guidelines to the teachers (the practitioners) and the school management team (head teacher and deputy heads). Specifically, the A&RTeam provides the aims, content, target groups and, most importantly, the activities and actions that schools could carry out in order to promote quality and equity. The handbook also provides clear suggestions on how to build school evaluation mechanisms, including the collection of relevant data, and the use of this information to promote quality and equity at the school level. The handbook is available through the web page http://www.ucy.ac.cy/promqe/en/resources.

Main study - The Intervention: Stages and Procedures

Ethical Aspects. All necessary authorisations and permissions to conduct the present study were settled by the participating countries' corresponding authorities, which varied according to the structure of the educational system of each country. More specifically, a consent form was signed by the parents of the students who participated in the study. In addition, all data were gathered anonymously (both from students and teachers). Anonymity was also applied at school level, since neither the names of the participating schools nor their region were made known to the public. Consequently, all data were entered in the data bank by using specific student, teacher and school codes.

Participants. At the beginning of school year 2015-2016, each country team (Cyprus, England, Greece, and Ireland) invited primary schools with more than 40% of their students coming from lower socioeconomic backgrounds located near their university to participate in the study. From all the invited schools, 72 from all four countries agreed to participate. Specifically, 24 primary schools were selected from Cyprus, and 16 schools from each one of the other three European countries. These schools were randomly split into two groups: the experimental (n=36) and the control group (n=36). All Grade 4, 5 and 6 students (n=5560) and all teachers (n=762) of the school sample participated in the study. Explicitly, a pre- measure of students' achievement in Mathematics and of the functioning of school level factors was conducted at the beginning of the school year. The research team of each country asked both groups of schools to develop and implement improvement strategies and action plans to improve their effectiveness. At the end of the school year, student learning outcomes in Mathematics and the functioning of school factors were again measured. At this point it should be mentioned that in regard to the student data, the response rate was higher than 75% in all participating schools. Missing data from students were only noticed in cases of absenteeism from school. In regard to the teacher data, the number of teachers answering to the questionnaire was not an issue in the present study since school factor scores were aggregated at the school level. However, each country team ensured a minimum number of participating teachers at each school (i.e. no less than 5 teachers) and the response rate of teachers was higher than 65% in each participating school. Below, a detailed description of the actions that took place in the schools of the experimental and control group is given.

The Treatment Offered to the Experimental Group. At the first stage of the intervention, training and provision of guidelines were offered to the participating primary schools (n=36). In detail, an external seminar to the head teachers of these schools was organized by each country team at the beginning of October 2015 to reach consensus on the general purpose of the intervention and to inform them about the main phases of the study/intervention, the role of the research team and the role of the school stakeholders (see Steps A and B of DASI, Chapter 2). Each country's research team explained the aims and methods of the study to each head teacher. It was made explicit to them that the team's role was to support schools to develop and implement their own improvement strategies and action plans, addressing factors operating at the school level and that the main goal of the intervention was to promote the learning of all students. It was also mentioned to them that they would not work with a specific group of students only and that they would further develop the policies of their schools by helping the various school stakeholders (i.e., teachers, parents, students, non-teaching staff) understand what their role was meant to be and by supporting each group of school stakeholders to implement their improvement strategies and action plans effectively. After this seminar, country teams administered the pre-tests to all students of Grades 4, 5 and 6 to collect data on their basic Mathematics skills (October-November 2015). Data on the functioning of each school's policy for teaching and policy on creating a learning environment were also collected during this period by using the teacher questionnaire. The analysis of data from each school of the experimental group from the four participating countries, revealed which factors seem to perform less well than all the others (Step C of DASI, Chapter 2). More specifically, for each school, separate analysis of the teacher responses to the questionnaire items was conducted, and those factors which had the lowest mean rank values were identified, indicating each school priorities for improvement. Specifically, the Kendall's W non-parametric test (Kendall & Babington, 1939) was applied to rank all the school factors based on their functioning. Kendall's W test is used to determine whether there is consensus among the teachers' perceptions in regard to the functioning of the factors. By using this test, it was found that teachers in each school agree among themselves on how the school factors can be ordered. Then by using the Wilcoxon signed-rank test (Wilcoxon, 1945) it was found which factors seem to perform less well than all the others. The results were reported to each school and stakeholders in the experimental group were encouraged to develop their strategies and action plans in order to improve the functioning of those factors for which lower mean rank values were estimated. A similar approach was used in analysing teachers' responses to the questionnaire at the end of the intervention. The

reports sent to the schools at the end of the intervention made suggestions regarding the improvement areas that each school could consider in developing its own strategies and action plans during the next school year (i.e., 2016-2017).

Each country team then visited the schools of the experimental group and participated in staff meetings to announce the results of the above analysis. In detail, the A&RTeam of each country gave to each school a report indicating the factors which seem to perform less well than all the others and discussed on the rationale of the dynamic approach and on the importance of each one of the school level factors (November 2015).

At the next step of the intervention, the A&RTeam provided support to the schools to help them develop their actions plans (Step D of DASI, Chapter 2). Each school of the experimental group decided whether their action plans would address one, or a combination of priorities concerning the factors included in the dynamic model. It was strongly recommended that decisions of their priorities for improvement should be taken not only by the teachers and the school management team. Students and parents should also be actively involved in the decision making process. For this reason, schools were encouraged to establish a committee with representatives of parents, students and teachers to discuss the results and gradually reach a consensus about the priorities of the school and how to deal with them. The final decision was announced to the whole school community and feedback was provided which helped schools to produce a clear definition of their improvement area. Then, school stakeholders in cooperation with the A&RTeam developed their strategies and action plans addressing specific aspects of the domains that they were focusing on based on the handbook given to them (November-December 2015). Table 3.3 shows the improvement areas chosen to be addressed by each experimental school per country. While one can observe that same areas were addressed by different schools of the same country (for example in Cyprus 8 out of the 12 schools and in Greece 6 out of the 8 schools were concerned with improving their policy on quality of teaching, whereas in Ireland 5 out of the 8 schools chose to improve their policy on the provision of sufficient learning resources for students and teachers, and in England 6 out the 8 schools chose to improve their policy on student behaviour outside the classroom), it should be reminded that DASI is based on the assumption that each school should develop strategies and action plans addressing its own needs and after a decision taken by the school stakeholders. DASI is based on the value assumption that authentic change comes primarily from within the organisation and does not expect the central authority (e.g., the Ministry of Education) to ask all schools to develop strategies and action plans addressing the same school factor(s).

Table 3.3

School Factors Selected for Improvement by each Experimental School by Country During the School Year 2015-16

School Code	Cyprus
1	A. Provision of sufficient learning resources for students and teachers B. Quality of teaching C. Quantity of teaching
2	A. Partnership policy
3	A. Quality of teaching B. Student behaviour outside the classroom
4	A. Quantity of teaching B. Quality of teaching
5	A. Partnership policy B. Provision of sufficient learning resources for students and teachers
6	A. Quantity of teaching B. Quality of teaching C. Partnership policy
7	A. Provision of learning opportunities
8	A. Quality of teaching B. Partnership policy
9	A. Partnership policy
10	A. Quality of teaching
11	A. Quality of teaching
12	A. Student behaviour outside the classroom B. Quality of teaching
	Greece
1	A. Student behaviour outside the classroom B. Collaboration and interaction between teachers C. Partnership policy D. Provision of sufficient learning resources for students and teachers
2	A. Quality of teaching
3	A. Quality of teaching B. Quantity of teaching
4	A. Partnership policy B. Quantity of teaching C. Quality of teaching
5	A. Quality of teaching B. Quantity of teaching
6	A. Quality of teaching B. Quantity of teaching
7	A. Quality of teaching B. Quantity of teaching
8	A. Partnership policy
	Ireland
1	A. Provision of sufficient learning resources for students and teachers B. Collaboration and interaction between teachers C. Quality of teaching

2	A. Provision of sufficient learning resources to students and teachers B. Collaboration and interaction between teachers
3	A. Quantity of teaching B. Quality of teaching
4	A. Quality of teaching
5	A. Student behaviour outside the classroom B. Provision of sufficient learning resources for students and teachers C. Quantity of teaching
6	A. Provision of sufficient learning resources for students and teachers B. Quantity of teaching C. Quality of teaching
7	A. Student behaviour outside the classroom B. Quantity of teaching C. Quality of teaching
8	A. Student behaviour outside the classroom B. Quantity of teaching C. Provision of sufficient learning resources for students and teachers
	England
1	A. Student behaviour outside the classroom B. Provision of learning opportunities
2	A. Student behaviour outside the classroom B. Quantity of teaching
3	A. Quantity of teaching B. Student behaviour outside the classroom
4	A. Student behaviour outside the classroom B. Collaboration and interaction between teachers
5	A. Student behaviour outside the classroom
6	A. Student behaviour outside the classroom
7	A. Quality of teaching B. Quantity of teaching
8	A. Provision of learning opportunities

It was explicitly stated that the action plan should not only *refer to the activities* that should be taken, but should also indicate *who was supposed to do each activity*, what the *time-schedule* was and what *resources* were needed. At this point, the schools were also reminded to make use of the suggestions and additional reading sources provided in the handbook, in order to specify the activities of their improvement project. School stakeholders then had to divide the work on developing their action plans by appointing different groups or committees for specific areas. At all stages, and especially in developing those action plans, members of the A&RTeam provided support to the school stakeholders. A template of the action plan given to schools is presented in Appendix F. Also in Appendix H, examples of action plans and strategies taken by the schools of this group to improve their effectiveness and the support provided by the A&RTeam, are given.

Beyond designing action plans, school stakeholders were further asked to make decisions regarding the monitoring of the implementation of their strategies and action plans. For example, some schools decided that a log book should be kept by the coordinator of the improvement effort, as well as from those stakeholders who were responsible for implementing specific aspects of their action plans. School stakeholders were also asked to share their experiences/views with the management team and other stakeholders. If a problem arose in implementing aspects of the action plans, school stakeholders in cooperation with the A&RTeam had to improve their action plans and/or provide support to those stakeholders not in a position to implement particular tasks of the action plans. To achieve this, frequent monitoring of the implementation of the action plans was carried out from early December 2015 till May 2016 (step E of DASI, Chapter 2). Specifically, the country teams were visiting schools of the experimental group once every six weeks to provide feedback and support in the implementation and/or in re-designing the action plans. A network within and across countries between schools addressing the same factors was also developed in order to share experiences during the implementation of their school improvement strategies.

Summing up, the implementation of DASI lasted for approximately eight months and the A&RTeam provided support to the school stakeholders by helping them overcome difficulties and problems that emerged during the implementation of their action plans according to the circumstances and specific needs of different groups of each school. The proper modification of action plans was found to reduce the chance of a school discovering only too late that no progress was made through the school year, due to the poor implementation of its action plans. It is worth mentioning that the following principles/values were stressed from the beginning of the implementation of DASI to schools of the experimental group and were continually repeated to school stakeholders until the end of the implementation:

- ***In order to have success and achieve the goals set, except for undertaking a significant number of actions, these actions have to be well allocated in time and provided throughout the year:*** The actions/strategies need to take place over a long time period in order to have results. Also consistency and flexibility in redefining the school policy and in the implementation of your actions is needed (stage dimension). For example, many schools when developing their policy undertake a lot of their actions during the beginning of the year (e.g., October, November) when there is an openness for the intervention. However, this does not have a long lasting

impact and the efforts will end up in failure because the actions were constrained in a small period.

- ***Keeping a balance between those actions that are too specific and those that are too general:*** General instructions to the parents or the teachers can help them undertake initiates, but when the problem is serious and they are not ready to face it, more specific instructions on what they can do to solve this problem have to be provided. The activities, actions, and strategies should not always be either too specific or too general but sometimes give the opportunity to teachers and the other stakeholders to design their own actions whereas in other cases specific suggestions addressing a serious problem should be given (focus dimension).
- ***School stakeholders should be flexible and modify their action plans according to the specific needs of each student/teacher:*** Activities do not need to be implemented in the same way for all the teachers involved. For example, some teachers may need support to confront misbehaviour, whereas other teachers are able to handle it by themselves. In addition, if one school finds out that some parents instead of helping the school to implement its policy, their behaviour to their children is problematic (e.g., violence at home) most of the suggestions given in the section on partnership policy are not appropriate for this group of parents and consequently the school should treat them in a completely different way, for example by asking the support of social services and/or of a school psychologist. It is expected that adaptation to the specific needs of each school stakeholder will increase the successful implementation of the strategies and actions to promote quality and equity (differentiation dimension)**.**
- ***Through monitoring the implementation of the intervention, it is very likely that practical difficulties and probably weaknesses will be identified in the action plans:*** It is essential that immediate actions are taken to improve and redefine the action plans in order to achieve the goals set. This does not necessarily imply that the original action plans were insufficient but merely that they are not fit for long time periods. The timely changing of the action plans will contribute to achieving the aims of the school and reduce the chance to find out at the end of the school year that no progress was made due to the fact that your action plans were either not implemented properly or could not contribute to the promotion of quality and/or equity. The above procedure stresses the importance of a shared responsibility of the whole school community in developing and implementing strategies and actions to improve the effectiveness of your school. However, it should also be acknowledged

that the role of teachers and their active involvement is crucial for the success of this intervention. Therefore, it is recognised that the successful implementation of the intervention depends on the active involvement of teachers and their contribution in designing the action plans by bringing their knowledge and experiences.

At the end of the school year (May-June 2016) each country team collected the final data from the experimental schools (step F of DASI, Chapter 2) using the teacher questionnaire, the student questionnaire and the Mathematics tests to evaluate the impact of the intervention on: a) improving the school factors, b) promoting student learning outcomes in mathematics (quality) and c) reducing differences in mathematics achievement between students coming from different socioeconomic backgrounds (equity).

Handling Schools of the Control Group. Each country team administered the pre-tests to all students of Grades 4, 5 and 6 of the control group schools (n=36) to collect data on their basic Mathematics skills (October-November 2015). Data on the functioning of each school's policy for teaching and policy on creating a learning environment were also collected during this period by using the teacher questionnaire. The analysis of data for each school of the control group from the four participating countries, followed the same procedure as in the schools of the experimental group (see next section). In order to be able to evaluate the impact of DASI, the A&RTeam of each country provided feedback to the control group schools about the results that emerged from a pre-measure concerned with the functioning of the school factors of the dynamic model *but without mentioning what their improvement priorities are.* Specifically, a report was sent to each school of the control group indicating the mean and standard deviation of each question of the teacher questionnaire. Therefore, each school of this group could use these results in an autonomous way and develop their own strategies and action plans as they like. These schools were offered support to develop these action plans, but no seminars/further training/feedback on the basis of DASI were offered, so DASI was not implemented (see Appendix H for examples of actions taken by the schools of this group to improve their effectiveness and the support provided by the A&RTeam). Consequently, each school decided to develop strategies and action plans to improve different school factors but only some of the schools were concerned with the improvement of factors included in the dynamic model (but without the knowledge that these factors are included in the model and without having access to the relevant handbook). By following this approach, equal support was provided to each group and at the same time, in order to control for the Hawthorne effect in two ways: both groups put the same amount of effort in their specific

treatment and schools of each group were not aware of the other treatments, avoiding compensatory rivalry or resentful demoralisation by any of the group (Shadish et al., 2002). At the end of the school year (May-June 2016) each country team collected the final data from the control group schools using the same measurement instruments as the ones in the experimental group. In this way, the impact of DASI is evaluated.

The next part of this chapter refers to the methods used for the analysis of the data derived from the three measures (i.e. of the students' achievement in Mathematics, of the functioning of the school level factors of the dynamic model, and of the students' SES). Information about the analysis of the final data to measure the impact of DASI on improving the functioning of the school level factors, on promoting student achievement in Mathematics and on reducing the effect of the socioeconomic background of the students on their Mathematics learning outcomes, are also provided.

Analysis of the Data

Analysing Data from the Teacher Questionnaire. As mentioned in the previous section of this part of this chapter, the explanatory variables which refer to the school level factors of the dynamic model were measured by the teacher questionnaire (see Appendix A). This questionnaire was completed by all teachers of the school sample (n=762). As it is anticipated that teachers within a school are or should be aware of the policy of their school and the evaluation mechanisms of their school similarly, but differently from teachers in other schools, a generalisability study was initially conducted. For each participating country, one-way analysis of variance (ANOVA) revealed that the data could be generalised at the school level, as for all the questionnaire items, the between-group variance was higher than the within-group variance ($p < 0.05$). Reliability was then computed for each of the dimensions of the school factors by calculating multilevel λ (Snijders & Bosker, 2011) and the Cronbach alpha for data aggregated at the school level. The value of the Cronbach alpha represented consistency across items, whereas multilevel λ represented consistency across groups of teachers. The results are presented in Table 3.4.

For all factors the reliability coefficients were high (around .80). Also, by using the Mplus software (Muthén & Muthén, 2015), the intra-class correlations (ICC) of the scales were computed. The ICC, which indicate what amount of variance in the teacher questionnaire is located at the school level, are also illustrated in Table 3.4. Specifically, it was found that the percentages of variance at the school level were between 29% and 38%. These percentages are relatively high compared to the results of other instruments that

measure perceptions of people or objects in clustered or interdependent situations (den Brok et al., 2002).

Table 3.4

Cronbach Alpha (Reliability), Multilevel λ (Consistency), and Intra-Class Correlations (ICC) of Scales Emerging from the Teacher Questionnaire Concerned with each Factor at the School level

School Factors	Cronbach Alpha (Reliability)	Multilevel λ (Consistency)	Intra-Class Correlations (ICC)
School policy for teaching			
Quantity of teaching	0.83	0.82	0.35
Provision of learning opportunities	0.82	0.84	0.33
Quality of teaching	0.81	0.82	0.36
Policy on the school learning environment (SLE)			
Student behaviour outside the classroom	0.87	0.88	0.29
Collaboration and interaction between teachers	0.84	0.83	0.31
Partnership policy	0.83	0.86	0.38
Provision of resources	0.85	0.87	0.35
School evaluation			
Evaluation of school policy for teaching	0.82	0.86	0.35
Evaluation of the SLE	0.84	0.83	0.33

To test the construct validity of the questionnaire, separate Structural Equation Modelling (SEM) analyses using EQS software (Bentler, 1995) were conducted for each one of the three overarching factors: a) *school policy on teaching*, b) *policy on the SLE*, and c) *school evaluation*. Additionally, for each one of the three overarching factors another model was tested in order to compare its fitting indices with the data from the three

proposed theoretical models (i.e., model 1). In these alternative models (model 2) all items that were used for the SEM analyses of each one of the three overarching factors were considered to belong to a single factor. The fit indices of each model per school factor are shown in Table 3.5, where it can be seen that model 1 was found to have the best fitting and that in each case (i.e., overarching factor) the fit indices of this model were satisfactory.

Table 3.5

Fit Indices of the Models that Emerged from the SEM Analyses of the Teacher Questionnaire used to Measure each Overarching School Factor

Models	**X^2**	**Df**	**X^2/df**	**p**	**CFI**	**RMSEA**	**Range RMSEA**
School policy on teaching							
Model 1	140	16	8.75	0.001	0.992	0.051	0.045 – 0.058
Model 2 (one factor model)	493	20	24.7	0.001	0.941	0.093	0.085 – 0.099
Policy on the school learning environment							
Model 1	679	96	7.1	0.001	0.967	0.052	0.045 – 0.063
Model 2 (one factor model)	3888	135	28.8	0.001	0.738	0.099	0.096 – 0.107
School evaluation							
Model 1	544	57	9.54	0.001	0.969	0.056	0.048 – 0.060
Model 2 (one factor model)	1545	65	23.8	0.001	0.895	0.093	0.089 – 0.096

Each model was estimated by using normal theory maximum likelihood methods (ML). Three separate fit indices were used to evaluate the extent to which the data fitted the tested models: the scaled chi-square, Bentler's (1990) comparative fit index (CFI) and the root mean square error of approximation (RMSEA) (Brown & Mels, 1990). Finally, the factor parameter estimates for the models with acceptable fit were examined to facilitate the interpretation of the models.

For each overarching factor, Multiple Group Confirmatory Factor Analysis (MGCFA) was then conducted to test whether the teacher questionnaire elicit similar

response patterns across the four countries. Specifically, measurement invariance can be examined on three sequential levels: configural, metric, and scalar (Kline, 2015). Configural invariance investigates the extent to which the pattern of fixed and free factor loadings among and between factors and items is the same and a value of RMSEA is expected to be smaller than 0.05 (Wu et al., 2007). For each overarching factor, configural invariance was supported since for each country the values of RMSEA were found to be around 0.05 and the values of CFI were higher than 0.94. The second step of invariance involves the examination of metric invariance by comparing the baseline model (which allows the factor loadings to be freely estimated across multiple groups) and the invariance model (which expects the factor loadings to be equal across the four country groups). Differences between the two nested models can be examined with the chi-square difference test (Muthén & Muthén, 2012) and the ΔCFI (Cheung & Rensvold, 2002). It was first of all found that for each overarching factor the baseline model fit the data adequately (i.e., CFI bigger than 0.96 and RMSEA smaller than 0.06). Then, all the factor loadings across the four country groups were constrained to be equal but for two overarching factors (i.e., policy for school learning environment and school evaluation) the data did not fit adequately to the relevant models (i.e., CFI smaller than 0.90 and RMSEA bigger than 0.15). Moreover, for each overarching factor the corrected chi-square difference test indicated that the factor loading invariant model was significantly worse than the baseline model. In addition, the ΔCFI was much bigger than 0.01 indicating that the metric invariance of the teacher questionnaire was not supported for any of the three scales measuring the overarching school factors.

The lack of metric and scalar invariance makes factor score comparisons invalid since differing response mechanisms seem to underlie country-group answers to the items of each overarching factor (Brown et al., 2017). However, the purpose of this study was not to compare the overarching factor scores across the four countries but to measure the effect of DASI in each country. Even if measurement invariance was established, comparison across the four countries would have not been conducted especially since the sample in each country was not nationally representative. Nevertheless, it was decided to conduct four separate within country-analyses to measure the effect of DASI on student achievement gains in each country. Since configural invariance was achieved, it was also decided to generate factor scores by taking into account teacher responses to the equivalent questionnaire items by considering the SEM model emerged in each country.

Analysing Data from the Mathematics Tests. The written Mathematics tests administered during the main study were subject to control for reliability and validity. The face and content validity of each test was evaluated by a group of expert teachers and teaching mathematics academics in each participating country as already mentioned in the previous part of this chapter.

Since the main aim was to generate an overall score of students' achievement in mathematics at the beginning of the intervention and a comparable score of their achievement at the end of the intervention, IRT was used to analyse the data that emerged from students' responses to these tests. However, classical test theory was also used to investigate the reliability and the properties of the test items. Specifically, the conventional item analysis programme ITEMAN was used and item-level statistics per test and country were computed. It was found that the criteria of Cronbach (1990) for the values of the discrimination index and difficulty level of each item were satisfied. Within-country analyses were also conducted to examine the reliability of the findings, by calculating the relevant values of Cronbach's alpha for the scales used to measure student achievement at the beginning and at the end of the intervention per country.

Table 3.6 shows that the internal reliability of each test was very good, since all coefficients of Cronbach's Alpha were higher than 0.87. It is also important to note that high inter-item reliability was identified, with all item-total correlations within each test being highly significant. The mean and standard deviation scores of each test per country are also presented in Table 3.6. By taking into account that a scale from 0 to 25 was used to measure mathematics achievement, one can see that the mean values were close to the midpoint of the scale. This implies that, overall, the students of each country found the tests neither too easy nor too difficult. Moreover, the values of the standard deviations in each country were relatively high. This implies that in each country there was enough variation in the responses of students in each test. Finally, the ceiling and floor effects in the attainment data were not observed, as none of the respondents achieved a full score and none scored zero. Moreover, in each country no more than 14% of the students achieved over 85% of the maximum score and less than 12% of the students achieved less than 10% of the maximum score.

Table 3.6

Means and Standard Deviations of Scores Measuring Mathematics Achievement at the Beginning and at the end of the Intervention per Grade and Country and the Values of Cronbach's Alpha of each Test used to Generate the Scores

	Before			After		
Country	**Mean**	**SD**	**a**	**Mean**	**SD**	**a**
CYPRUS						
Grade 4	11.21	5.98	0.87	12.29	7.26	0.89
Grade 5	13.82	6.94	0.88	13.91	8.24	0.92
Grade 6	14.11	7.27	0.89	14.28	7.70	0.90
ENGLAND						
Grade 4	10.38	5.63	0.89	11.60	7.75	0.91
Grade 5	13.18	8.51	0.91	14.62	8.57	0.93
Grade 6	14.73	7.31	0.90	14.29	6.82	0.91
GREECE						
Grade 4	10.85	5.63	0.88	13.20	7.95	0.89
Grade 5	12.62	7.78	0.88	13.74	8.19	0.92
Grade 6	13.71	8.09	0.94	14.14	7.91	0.91
IRELAND						
Grade 4	13.20	5.30	0.89	13.69	8.18	0.91
Grade 5	13.68	7.56	0.90	14.03	8.53	0.92
Grade 6	14.28	7.49	0.92	14.83	7.59	0.91

Note 1: Achievement is based on students' total test score on a scale from 0 to 25 (i.e., before running the test equating procedure). Number of participants per country is as follows: Cyprus (n=1790), England (n=990), Greece (n=1286), and Ireland (n=1494).
Note 2: At the beginning of the school year, the age of students per grade is as follows: Grade 4 students are expected to be between 9 and 10 years old, Grade 5 students are expected to be between 10 and 11 years old, and Grade 6 students between 11 and 12 years old.

Equating of Tests. The test administered to Grade 6 students when they were at the end of the school year was purposefully more difficult than the one administered to Grade 4 students when they were at the beginning of the school year, so as to correspond to their age skills, maturity stage, and level of mathematics knowledge. As a consequence, IRT was used for equating the tests (Hambleton & Swaminathan, 1985). Since the tests used to generate scores in the four countries were not in the same language, a decision was

made to conduct four separate within-country equating procedures to analyse the data. Specifically, the scores were transformed into the same scale on the basis of the characteristics of IRT models, with students' latent level of ability (y) and difficulty level of an item (b) being identical when certain preconditions were fulfilled (Bond & Fox, 2001). The latent ability level for each student could be determined in every version as long as there were so-called 'anchoring items' connecting the versions. For the purposes of this study, sufficient common items (i.e., approximately 15 per cent of anchoring items across all tests) with representative content to be measured (Kolen & Brennan, 1995) were used. Estimation was made using the Extended Logistic Model of Rasch (Andrich, 1988) and separate within-country analyses were conducted. The within-country analyses revealed that each scale had satisfactory psychometric properties in each country. Specifically, for each scale the indices of cases (i.e., students) and item separation were higher than 0.82, indicating that the separability of each scale was satisfactory (Wright, 1985). Moreover, the infit mean squares and the outfit mean squares of each scale were near one and the values of the infit t scores and the outfit t scores were approximately zero. Furthermore, each analysis revealed that all items had item infit with the range 0.84 to 1.19. Therefore, for each assessment period, achievement in mathematics was estimated by calculating the Rasch person estimates.

Analysing Data from the Student Questionnaire. The student questionnaire administered at the end of the intervention, was used to collect data on four student background factors: gender (0=boys, 1=girls), ethnicity (0=other, 1=immigrant background), language spoken at home (0=other language, 1=language of instruction at school) and SES. There were five SES variables available: father's and mother's education level, the social status of the father's job, the social status of the mother's job and the main elements of the home learning environment. Information regarding the parents' educational level was obtained directly from the school records since primary school children might not able to give accurate information about this variable. Parents' occupation was classified into three groups: occupations followed by the working class (63%), occupations followed by the middle class (28%), and occupations followed by the upper-middle class (9%). All five variables were considered in establishing an SES score since variation across the five variables per student can be observed. For example, it is possible that a father has a professional job whereas a mother does not. It may also be possible that a father has a university degree but currently has a blue-collar job. It was for this reason that data emerged from all five variables were taken into account in generating an SES score.

Data emerged from another part of the student questionnaire which was concerned with the main elements of the home learning environment (i.e., learning materials available at home and learning opportunities offered at home) were also taken into account for generating this score. The Extended Logistic Model of Rasch (Andrich, 1988) was used to analyse all SES data. Thus a scale which referred to the student SES score was created and analysed for reliability, fit with the model, meaning and validity. Analysis of the data revealed that the scale had relatively satisfactory psychometric properties. Specifically, the indices of cases (i.e. students) and item separation were higher than 0.87, indicating that the separability of the scale was satisfactory (Wright, 1985). Furthermore, the infit mean squares and the outfit mean squares of each scale were near one and the values of the infit t-scores and the outfit t-scores were approximately zero. The analysis revealed that there was a good fit with the model (Keeves & Alagumalai, 1999). Thus an overall score for the SES of each student was calculated using the relevant Rasch person estimate in the overall SES scale.

Regarding the measure of ethnicity, it should be acknowledged here that this variable was calculated based on the answers given to *Question 2* of the student questionnaire (see Appendix E) regarding the country of origin of the students. Initially, three groups of students were formed according to their origin: students born in the test country, students born in another country (1st generation) and students born in the test country with one or both parents born in another country (2nd generation). However, since a limited number of 2nd generation cases appeared, 1st and 2nd generation students were combined into one category. Moreover, it was not possible to identify the country of origin of those students who were not born in the test country (or the country of origin of their parents). Therefore, ethnic groupings were not taken into account when measuring this variable. This limitation should be considered in interpreting the results about the impact of this student background factor on student achievement.

Analysing Data to Investigate the Impact of DASI on Improving the School Factors and on Promoting Quality and Equity in Schools. Since this study aimed to examine the impact of DASI to promote quality and equity in the schools of the four participating countries, a value-added approach was used by collecting data both at the beginning and at the end of the intervention. Moreover, schools were randomly allocated to two groups (experimental and control) and thus two different types of approaches were implemented. By following this research design (see previous part of this chapter), it was made possible to conduct summative evaluation of DASI and search for its impact on:

1. Improving the school factors of the dynamic model (school policy for teaching, policy for creating the SLE, and school evaluation)
2. Improving student learning outcomes in Mathematics
3. Reducing the impact of the socioeconomic background characteristics of students on their learning outcomes in Mathematics

The analyses of data were based on four steps. Although a group randomisation study was conducted, first of all the experimental and control groups were compared not only in terms of the prior achievement of their students but also in terms of the three student background factors (SES, gender and ethnicity) and the functioning of school factors in order to make sure that the two groups were comparable in terms of their student learning outcomes and all factors considered in this study that may affect their effectiveness status in terms of the quality dimension.

Since the equity dimension is measured by investigating the impact of each background factor on student achievement, it was initially decided to compare the two groups in terms of the effect sizes of each of the three background factors on student achievement at the beginning of the intervention to make sure that these effect sizes were equally strong in the experimental and the control group. Due to the nested character of the data (students within classes within schools), at this second step of analysing data two separate multilevel regression analyses (Goldstein, 2003; Luyten & Sammons, 2010; Snijders & Bosker, 2011) of student achievement at the beginning of the intervention (one for the experimental and one for the control group) were ran and the effect of each background factor on prior achievement of students of each group was estimated.

In the third step of the analysis, the impact of the intervention upon the functioning of each overarching school factor of the dynamic model (SLE, school policy on teaching, and school evaluation) was investigated, since these factors were directly addressed through the action plans developed by the schools of the experimental group.

In the final step of the analysis, multilevel regression analysis of student achievement at the end of the intervention was carried out to find out whether students of the experimental group managed to achieve better learning outcomes in mathematics at the end of the school year. In the last model, an interaction effect between each background factor and the dummy variable indicating whether each school made use of DASI (or was part of the control group) was added. In this way, it was able to search for the extent to which the impact of each background factor on final achievement became smaller in the experimental than in the control group.

Methodological Limitations

As in every research design, it should be acknowledged that limitations exist in the present study and should be reported to help readers better understand the emerged results and encourage researchers in the field of EER to design relevant studies by taking into account these boundaries to achieve better results and/or undertake different targets. The first limitation is the fact that the present study aims towards students' cognitive outcomes in one only learning subject (Mathematics). This is due to the fact that the study takes place in four different European countries with two different national languages (Greek and English) and different contexts in the other subjects (e.g. History). Since a common test should have been designed, Mathematics were the only subject to choose as the main student outcome of the study. This, as well, enabled each country team to save valuable time when correcting the students' tests since the correction guide for Mathematics is simpler than any other school subject. Other experimental studies may of course be conducted to provide evidence about the impact of DASI on different learning outcomes other than Mathematics, in other domains (e.g., affective and psychomotor), and on meta-cognition.

Second, this study has searched for the impact of a specific approach (i.e. DASI) on student achievement in schools situated in socially disadvantaged areas and not in typical schools. Thus, one should take into account that there might be other factors beyond those of the dynamic model that may as well be associated with student learning outcomes in these schools, which are not measured in the present study. Researchers suggests that what is important is academic achievement, which is related to educational attainment but also to a list of other factors like income and wealth inequality, access to day care and preschool programs, nutrition, health, neighbourhood safety and the emotional and psychological stress of parents and children (Lynch & Oakford, 2014). For instance, the support of the welfare services, the community, and the educational psychologists should be searched in order that schools can manage to overcome the great difficulties they are facing and focus on the achievement of better student outcomes and on the reduction of the initial achievement gap between their students.

Third, it should be considered that the experimental schools participating in the present study are volunteers. This means that the A&RTeam has not obliged any of these schools to participate in this study. Since 'ownership' is one of the main assumptions of DASI to be able to make a difference in schools, if a school is not willing to change then DASI is not implemented. The main question that arises here is whether DASI can be implemented

by schools of this 'difficult group' on a mandatory basis and under which conditions in order to achieve the highest possible results.

Fourth, it is essential to emphasise that this study investigates the impact of DASI on promoting quality and equity only at the school level and specifically in primary education. Therefore, studies investigating the impact of DASI on promoting quality and equity in secondary education are needed. Furthermore, the results emerged from this study especially for the equity dimension cannot predict the academic and/or professional development of the students. Longitudinal studies might give this kind of information and contribute in the international debate for enhancing educational policies that promote not only quality but also equity which can in the end reinforce the development of countries in all domains.

Fifth, data are collected only through one (school) year period of time and the intervention lasted for approximately eight months. Therefore, changes in the school policy and/or impact of these changes in the final student outcomes are only identified for this period of time. Thus, this study reveals the potential of investigating the impact of using DASI for a longer period on promoting quality and equity and consequently, there is a need of conducting longitudinal studies to identify changes in the effectiveness status of schools in terms of both quality and equity even after the intervention (sustainability). These studies can help us identify the extent to which there is time stability in measuring school effectiveness in promoting equity and may reveal factors that can explain changes in the effectiveness status of schools which can be used in order to establish a theory on promoting equity. In this way, possibilities for searching for mediating factors of the intervention could arise.

Finally, this study is conducted only in European countries (Cyprus, England, Greece, and Ireland), therefore its results might be contextual. Hence, it is important to conduct similar intervention studies in countries outside the European setting, to test whether DASI can promote both quality and equity under different circumstances.

Chapter 4: Results

Chapter 4 presents the results of the analyses mentioned in the last part of Chapter 3. Specifically, this chapter is divided into four parts. In the first part, the results of the inferential statistical analyses are presented which revealed that there were no statistically significant differences in student initial achievement, student background factors and the functioning of school factors between the control and experimental groups. In the second part, the impact of the intervention (i.e. DASI) on improving the school level factors of the dynamic model (i.e. SLE, school policy on teaching, and school evaluation) is shown. The third part of this chapter is concerned with the impact of the intervention (i.e. DASI) on promoting student learning outcomes in Mathematics (i.e., quality dimension). Specifically, the results of the multilevel regression analysis investigating the impact of the intervention on final student achievement are presented, to determine whether the use of DASI can explain differences in student achievement at the end of the intervention. The final part of this chapter refers to the impact of DASI on promoting the equity dimension of effectiveness by the identification of any differences in the effect sizes measuring the impact of each background factor (SES, gender and ethnicity) on student achievement between the control and the experimental group, at the beginning and at the end of the intervention.

Descriptive Data and Inferential Statistical Analyses

Descriptive data on student background factors, student achievement in mathematics and the functioning of school factors for each country are provided in Tables 4.1 and 4.2. It is observed that in each country the t-test did not reveal any statistically significant difference at the 0.05 level between the two groups (i.e., experimental and control) in relation to the SES of their students and their prior achievement in Mathematics (see Table 4.1). In addition, the Kolmogorov Smirnov two sample test did not reveal any statistically significant difference in the functioning of school factors at the beginning of the intervention between the experimental and the control groups (see Table 4.2). Regarding the other two student background factors (i.e., gender and ethnicity), the chi-square test did not reveal any statistically significant difference at 0.05 level between the experimental and control group in each participating country. These results reveal that at the beginning of the intervention there was no statistically significant difference at 0.05 level between the experimental and the control group in relation to student achievement in mathematics and all explanatory variables at student (i.e., student background factors) and school level (i.e.,

the functioning of school factors included in the dynamic model). This result can be attributed to the fact that a group randomisation study was conducted (see Connolly et al., 2018).

Table 4.1

Descriptive Data About the Background factors of the Students in the Experimental and the Control Group and Values of t-test per Country

	Experimental		Control		t-test		
Student Background Factors	**Mean**	**S.D.**	**Mean**	**S.D.**	**t**	**df**	**p**
CYPRUS							
Prior Achievement	0.64	1.11	0.68	1.13	-0.76	1788	0.449
Post Achievement	1.09	1.15	0.87	1.08	4.16	1788	0.001
SES	0.85	0.73	0.80	0.68	1.49	1788	0.135
Age in days	3805	393	3830	391	-1.58	1788	0.115
ENGLAND							
Prior Achievement	0.78	1.41	0.74	1.38	0.45	988	0.647
Post Achievement	1.22	1.40	0.98	1.39	2.69	988	0.007
SES	0.61	0.56	0.64	0.40	-0.97	988	0.331
Age in days	3472	327	3496	342	-1.13	988	0.259
GREECE							
Prior Achievement	0.72	1.43	0.68	1.35	0.51	1284	0.597
Post Achievement	0.98	1.25	0.81	1.16	2.52	1284	0.012
SES	0.65	0.57	0.70	0.58	-1.56	1284	0.123
Age in days	3730	329	3742	328	-0.65	1284	0.513
IRELAND							
Prior Achievement	0.90	1.32	0.85	1.34	0.72	1492	0.469
Post Achievement	1.24	1.29	0.99	1.13	4.14	1492	0.001
SES	0.55	0.53	0.51	0.66	1.29	1492	0.194
Age in days	3926	335	3938	344	-0.69	1492	0.498

Note: Number of participants in the experimental and control groups per country:
Cyprus: Experimental (n=930) / Control (n=860)
England: Experimental (n=489) / Control (n=501)
Greece: Experimental (n=677) / Control (n=609)
Ireland: Experimental (n=803) / Control (n=691)

Table 4.2

Means and Standard Deviations of the Functioning of each Overarching School Factor at the Beginning of the Intervention in the Experimental and Control Schools and Values of the Kolmogorov-Smirnov Two-Sample Test per Country

	Experimental School		Control School			
Overarching School Factor	**Mean**	**S.D.**	**Mean**	**S.D.**	**K-S Z**	**P**
CYPRUS						
School policy on teaching	2.96	0.87	2.98	0.69	-0.766	0.601
School learning environment	3.04	0.77	3.03	0.55	0.656	0.782
School evaluation	2.77	0.73	2.79	0.65	-0.774	0.587
ENGLAND						
School policy on teaching	3.11	0.86	3.15	0.82	-0.832	0.493
School learning environment	3.05	0.80	3.07	0.90	-0.799	0.547
School evaluation	2.95	0.96	2.93	0.89	0.661	0.765
GREECE						
School policy on teaching	3.05	0.83	2.98	0.89	0.914	0.874
School learning environment	3.10	0.72	3.13	0.73	-0.616	0.799
School evaluation	2.71	0.83	2.74	0.28	-0.963	0.312
IRELAND						
School policy on teaching	2.98	0.76	3.05	0.69	-0.821	0.502
School learning environment	2.89	0.86	2.84	0.79	0.799	0.547
School evaluation	2.81	0.82	2.87	0.83	-0.963	0.312

Finally, the analysis shows that in each participating country, a statistically significant difference in student achievement between the control and the experimental groups at the end of the intervention was observed (see Table 4.1). Specifically, students in the experimental group were found to have better results in Mathematics than those of the control group in each participating country. However, in order to evaluate the impact of the intervention on student achievement in mathematics at the end of the intervention, within-country multilevel regression analyses were conducted (see the third part of this chapter below).

The Impact of DASI on Improving the School Factors

The means and standard deviations of the three school-level overarching factor scores before the implementation of DASI and at the end of the intervention in the experimental and control schools in each participating country are shown in Table 4.3. Although MANOVA repeated measures of treatment (following DASI/not following the proposed approach) according to time (before [i.e. pre] /end [i.e. post]) could have been carried out with the three factor scores (i.e., policy on teaching, SLE, and school evaluation) as dependent variables, it was decided to compare the school factor scores of these two groups by using non-parametric statistical tests due to the small sample size at the school level (i.e., less than 15 schools in each group). When the sample size is small, non-parametric tests are preferable instead of parametric tests, even when interval data have been collected (see Siegel & Castellan, 1988). Therefore, the Kolmogorov-Smirnov Two-Sample Test was firstly used to seek for any statistically significant difference between the two groups in terms of the functioning of the three overarching school factors before the intervention. No statistically significant difference was identified at the 0.05 level. This implies that the two groups were performing equally well in relation to the functioning of the three overarching school factors. At the end of the intervention, the Kolmogorov-Smirnov Two-Sample Test revealed statistically significant differences at the 0.05 level between the two groups of schools in each participating country in relation to each school factor (see Table 4.3). Additionally, the Wilcoxon Test was used to detect whether there was any statistically significant progress in the performance of each group of schools in relation to the three overarching school factors. In each country, it was found that only the schools in the experimental group managed to improve the functioning of their school factors at a statistically significant level.

Table 4.3

Means and Standard Deviations of the Functioning of each Overarching School Factor in the Experimental and Control Schools Before and at the End of the Intervention and Values of the Kolmogorov-Smirnov Two-Sample Test

	Experimental School		Control School			
Overarching School Factor	**Mean**	**S.D.**	**Mean**	**S.D.**	**K-S Z**	**P**
CYPRUS						
A) Before the intervention						
School policy on teaching	2.96	0.87	2.98	0.69	-0.766	0.601
School learning environment	3.04	0.77	3.03	0.55	0.656	0.782
School evaluation	2.77	0.73	2.79	0.65	-0.774	0.587
B) At the end of intervention						
School policy on teaching	3.48	0.63	3.04	0.68	1.474	0.028
School learning environment	3.80	0.83	3.09	0.76	1.992	0.009
School evaluation	3.15	0.78	2.86	0.73	1.413	0.029
ENGLAND						
A) Before the intervention						
School policy on teaching	3.11	0.86	3.15	0.82	-0.832	0.493
School learning environment	3.05	0.80	3.07	0.90	-0.799	0.547
School evaluation	2.95	0.96	2.93	0.89	0.661	0.765
B) At the end of intervention						
School policy on teaching	3.46	0.90	3.17	0.84	1.389	0.038
School learning environment	3.42	0.86	3.08	0.88	1.989	0.007
School evaluation	3.29	0.91	2.91	0.89	1.467	0.031

GREECE						
A) Before the intervention						
School policy on teaching	3.05	0.83	2.98	0.89	0.914	0.874
School learning environment	3.10	0.72	3.13	0.73	-0.616	0.799
School evaluation	2.71	0.83	2.74	0.28	-0.963	0.312
B) At the end of intervention						
School policy on teaching	3.39	0.80	3.00	0.81	1.713	0.019
School learning environment	3.46	0.74	3.11	0.73	1.450	0.038
School evaluation	3.11	0.71	2.75	0.83	1.389	0.041
IRELAND						
A) Before the intervention						
School policy on teaching	2.98	0.76	3.05	0.69	-0.821	0.502
School learning environment	2.89	0.86	2.84	0.79	0.799	0.547
School evaluation	2.81	0.82	2.87	0.83	-0.963	0.312
B) At the end of intervention						
School policy on teaching	3.29	0.74	2.97	0.72	1.934	0.015
School learning environment	3.18	0.73	2.91	0.73	1.656	0.024
School evaluation	3.12	0.24	2.91	0.25	1.611	0.035

The Impact of DASI on Promoting Student Learning Outcomes in Mathematics

In each country, multilevel regression analysis was conducted to identify the impact of DASI on student achievement in Mathematics at the end of the intervention. More specifically, an empty model comprising of student, class and school levels was primarily used. In succeeding steps, explanatory variables at different levels were added, starting at the student level. Explanatory variables, apart from grouping variables, were centred as Z-scores with a mean of 0 and a standard deviation of 1. Grouping variables were entered as

dummies with one of the groups as the baseline (e.g., boys = 0). The models presented in Tables 4.4 to 4.7 were estimated without the variables that had no statistically significant effect at level 0.05.

In model 1 the context variables at each level (i.e., prior achievement, gender, SES, age and ethnicity) were added to the empty model. The likelihood statistic revealed a statistically significant change between the empty model and model 1 ($p < 0.001$). In each country, prior-achievement, SES and gender were found to be associated with student achievement at the end of the intervention. In addition, prior knowledge was the only contextual variable which had a significant effect on student achievement when aggregated at the school level. Moreover, model 1 was found to explain at least 38% of the total variance in each country and most of the explained variance was at the student level. In model 2, the impact of DASI was tested by adding a relevant dummy variable to model 1. By using the control group as a reference group, it was found that the schools which made use of DASI managed to achieve better outcomes than the control group in each participating country. It is therefore argued that the findings of model 2 show that the use of DASI in socially disadvantaged schools had an effect on promoting quality in education in each participating country. It is important to mention that the calculations in model 3 reveal that, in each country, there was no statistically significant interaction effect between the use of DASI and any background effect other than SES. Statistically significant interaction effects (Jaccard & Turrisi, 2003) at 0.05 level between the use of DASI and SES were identified in each participating country. These results are taken into account in the next part of this chapter, which shows the impact of DASI on promoting equity.

Table 4.4

Parameter Estimates and Standard Errors for the Analysis of Mathematics Achievement at the End of the Intervention for Cyprus (Students Within Classes, Within Schools)

Factors	Model 0	Model 1	Model 2	Model 3
Fixed part				
Intercept	0.85 (0.05)*	0.81 (0.05)*	0.56 (0.05)*	0.48 (0.05)*
Student level				
Prior achievement		0.68 (.02)*	0.67 (.02)*	0.66 (.02)*
Gender (0=boy, 1=girl)		-0.07 (.02)*	-0.07 (.02)*	-0.07 (.02)*
SES		0.18 (.04)*	0.17 (.04)*	0.23 (.04)*
Age		0.06 (.04)		
Ethnicity (0=other, 1=immigrant background)		-0.05 (.04)		
Class level				
Average prior achievement		0.11 (.04)*	0.10 (.04)*	0.10 (.04)*
Percentage of girls		-0.03 (.04)		
Average SES		0.07 (.04)		
Average age		0.04 (.04)		
Percentage of students with immigrant background		-0.05 (.03)		
School level				
Context				
Average prior achievement		0.14 (.06)*	0.13 (.06)*	0.13 (.06)*
Percentage of girls		-0.02 (.04)		
Average SES		0.06 (.04)		
Average age		0.04 (.04)		
Percentage of students with immigrant background		-0.03 (.03)		
DASI (0=control, 1=experimental)			0.24 (.02)*	0.25 (.02)*
DASI x SES				-0.13 (.03) *
Variance components				
School	11.2 %	9.8 %	4.1 %	3.1 %
Class	17.1 %	14.2 %	12.1 %	10.1 %
Student	71.7 %	36.3 %	35.1 %	33.1 %
Explained		39.7 %	48.7 %	52.7 %
Significance test				
X^2	6604.4	4862.3	4341.1	4310.0
Reduction		1742.1	521.2	31.1
Degrees of freedom**		5	1	1
p-value		.001	.001	.001

* Statistically significant effect at 0.05 level

** The models presented in this table were estimated without the variables that did not have a statistically significant effect at 0.05 level.

Table 4.5

Parameter Estimates and Standard Errors for the Analysis of Mathematics Achievement at the End of the Intervention for England (Students Within Classes, Within Schools)

Factors	Model 0	Model 1	Model 2	Model 3
Fixed part				
Intercept	0.99 (0.05)*	0.81 (0.05)*	0.66 (0.05)*	0.56 (0.05)*
Student level				
Prior achievement		0.62 (.03)*	0.62 (.02)*	0.63 (.02)*
Gender (0=boy, 1=girl)		-0.08 (.02)*	-0.07 (.02)*	-0.07 (.02)*
SES		0.45 (.04)*	0.44 (.04)*	0.51 (.04)*
Age		0.05 (.04)		
Ethnicity (0=other, 1=immigrant background)		-0.06 (.04)		
Class level				
Average prior achievement		0.13 (.04)*	0.12 (.04)*	0.12 (.04)*
Percentage of girls		-0.04 (.04)		
Average SES		0.08 (.04)*	0.08 (.04)*	0.11 (.04)*
Average age		0.06 (.04)		
Percentage of students with immigrant background		-0.06 (.04)		
School level				
Context				
Average prior achievement		0.17 (.06)*	0.16 (.06)*	0.16 (.06)*
Percentage of girls		-0.02 (.04)		
Average SES		0.13 (.04)*	0.13 (.04)*	0.11 (.04)*
Average age		0.04 (.04)		
Percentage of students with immigrant background		-0.03 (.03)		
DASI (0=control, 1=experimental)			0.16 (.03)*	0.16 (.03)*
DASI x SES				-0.13 (.03)*
Variance components				
School	14.2 %	12.8 %	9.5 %	8.5 %
Class	19.1 %	15.2 %	12.1 %	10.1 %
Student	66.7 %	33.3 %	32.1 %	31.4 %
Explained		38.7 %	46.3 %	50.0 %
Significance test				
X^2	3051.7	2021.3	1841.1	1800.6
Reduction		1030.4	180.2	40.5
Degrees of freedom**		7	1	1
p-value		.001	.001	.001

* Statistically significant effect at 0.05 level

** The models presented in this table were estimated without the variables that did not have a statistically significant effect at 0.05 level.

Table 4.6

Parameter Estimates and Standard Errors for the Analysis of Mathematics Achievement at the End of the Intervention for Greece (Students Within Classes, Within Schools)

Factors	Model 0	Model 1	Model 2	Model 3
Fixed part				
Intercept	0.81 (0.07)*	0.67 (0.06)*	0.46 (0.06)*	0.37 (0.06)*
Student level				
Prior achievement		0.52 (.03)*	0.52 (.03)*	0.51 (.03)*
Gender (0=boy, 1=girl)		-0.05 (.02)*	-0.05 (.02)*	-0.05 (.02)*
SES		0.35 (.06)*	0.34 (.06)*	0.39 (.06)*
Age		0.07 (.05)		
Ethnicity (0=other, 1=immigrant background)		-0.04 (.04)		
Class level				
Average prior achievement		0.21 (.04)*	0.19 (.04)*	0.19 (.04)*
Percentage of girls		-0.03 (.04)		
Average SES		0.05 (.04)		
Average age		0.04 (.04)		
Percentage of students with immigrant background		-0.04 (.04)		
School level				
Context				
Average prior achievement		0.17 (.06)*	0.16 (.06)*	0.16 (.06)*
Percentage of girls		-0.01 (.04)		
Average SES		0.05 (.04)		
Average age		0.02 (.04)		
Percentage of students with immigrant background		-0.01 (.03)		
DASI (0=control, 1=experimental)			0.28 (.02)*	0.28 (.02)*
DASI x SES				-0.11 (.02)*
Variance components				
School	13.6 %	11.8 %	7.1 %	5.6 %
Class	16.1 %	12.2 %	8.1 %	7.2 %
Student	70.3 %	36.0 %	34.1 %	33.0 %
Explained		40.0 %	50.7 %	54.2 %
Significance test				
X^2	2790.4	2100.3	1850.2	1805.1
Reduction		690.1	250.1	45.1
Degrees of freedom**		5	1	1
p-value		.001	.001	.001

* Statistically significant effect at 0.05 level

** The models presented in this table were estimated without the variables that did not have a statistically significant effect at 0.05 level.

Table 4.7

Parameter Estimates and Standard Errors for the Analysis of Mathematics Achievement at the End of the Intervention for Ireland (Students Within Classes, Within Schools)

Factors	Model 0	Model 1	Model 2	Model 3
Fixed part				
Intercept	0.82 (0.06)*	0.69 (0.05)*	0.45 (0.05)*	0.32 (0.05)*
Student level				
Prior achievement		0.51 (.03)*	0.51 (.03)*	0.50 (.03)*
Gender (0=boy, 1=girl)		-0.05 (.02)*	-0.05 (.02)*	-0.05 (.02)*
SES		0.31 (.04)*	0.31 (.04)*	0.35 (.04)*
Age		0.03 (.05)		
Ethnicity (0=other, 1=immigrant background)		-0.03 (.04)		
Class level				
Average prior achievement		0.06 (.04)		
Percentage of girls		-0.02 (.04)		
Average SES		0.03 (.04)		
Average age		0.02 (.04)		
Percentage of students with immigrant background		-0.02 (.03)		
School level				
Context				
Average prior achievement		0.13 (.06)*	0.12 (.06)*	0.12 (.06)*
Percentage of girls		-0.01 (.02)		
Average SES		0.03 (.04)		
Average age		0.02 (.03)		
Percentage of students with immigrant background		-0.01 (.04)		
DASI (0=control, 1=experimental)			0.32 (.02)*	0.31 (.02)*
DASI x SES				-0.09 (.02)*
Variance components				
School	12.1 %	10.8 %	7.1 %	5.5 %
Class	16.1 %	13.2 %	9.3 %	8.2 %
Student	71.8 %	37.1 %	34.5 %	32.1 %
Explained		38.9 %	49.1 %	54.2 %
Significance test				
X^2	5458.2	4157.1	3937.0	3880.0
Reduction		1301.1	220.1	57.0
Degrees of freedom**		4	1	1
p-value		.001	.001	.001

* Statistically significant effect at 0.05 level

** The models presented in this table were estimated without the variables that did not have a statistically significant effect at 0.05 level.

The Impact of DASI on Promoting Equity in Education

The calculations in model 3 in the Tables 4.4 to 4.7, which seek to identify interaction effects between the use of DASI and student background factors on final learning outcomes in mathematics, can only be interpreted when the impact of background factors on prior achievement in each group are identified and compared. Consequently, two separate within-country multilevel analyses of prior achievement were conducted for each group of schools (see Table 4.8). The results of the two separate multilevel analyses of prior achievement in each participating country, revealed that only the SES and the gender were related with the achievement of each group of students at the beginning of the intervention. The fixed effect obtained from each multilevel analysis of SES and gender were then converted into standardised effects or 'Cohen's d' by following the approach proposed by Elliot and Sammons (2004). When using this approach, it was found that the effect sizes of SES and gender on prior achievement were equally high for each group of students in each participating country (see Table 4.9). As no interaction effect between the use of DASI and gender on final learning outcomes was identified, one can argue that the impact of gender was equally strong in the two groups of schools at the beginning as well as at the end of the intervention. This indicates that the use of DASI had no effect on promoting equity in terms of the impact that gender has on student learning outcomes. Conversely, the ***negative statistically significant interaction effect between the use of DASI and SES on final learning outcomes*** (see model 3 of Tables 4.4 to 4.7) seems to expose that ***the effect of SES on final achievement was smaller in the schools which made use of DASI*** in each participating country (compared with the effect of SES on final achievement in the schools of the control group). Since that the effect of SES on prior achievement was equally strong in the two groups, it could be argued that the intervention had an impact on promoting the equity dimension concerned with the impact of SES on achievement in the four participating countries.

Table 4.8

Parameter Estimates and Standard Errors for the Analysis of Mathematics Achievement of Students in the Experimental and the Control Group per Country at the Beginning of the Intervention (Students Within Classes, Within Schools)

	Cyprus		England		Greece		Ireland	
Factors	**Experimental**	**Control**	**Experimental**	**Control**	**Experimental**	**Control**	**Experimental**	**Control**
Fixed part								
Intercept	-0.42 (0.05)*	-0.41 (0.05)*	-0.32 (0.04)*	-0.34 (0.04)*	-0.38 (0.04)*	-0.37 (0.04)*	-0.46 (0.06)*	-0.48 (0.06)*
Student level								
Gender (0=boy, 1=girl)	0.09 (0.03)*	0.09 (0.03)*	0.15 (0.03)*	0.17 (0.03)*	0.11 (0.03)*	0.10 (0.03)*	0.17 (0.04)*	0.20 (0.05)*
SES	0.34 (0.05)*	0.32 (0.05)*	0.29 (0.05)*	0.27 (0.05)*	0.38 (0.05)*	0.36 (0.05)*	0.28 (0.05)*	0.30 (0.05)*
Age	0.12 (0.04)*	0.11 (0.04)*	0.11 (0.04)*	0.11 (0.04)*	0.13 (0.04)*	0.12 (0.04)*	0.16 (0.04)*	0.16 (0.04)*
Ethnicity (0=other, 1=immigrant background)	-0.08 (0.05)	-0.07 (0.05)	-0.12 (0.04)*	-0.10 (0.04)*	-0.11 (0.04)*	-0.12 (0.04)*	-0.15 (0.05)*	-0.16 (0.05)*
Class level								
Percentage of girls	0.04 (0.06)	0.05 (0.06)	0.06 (0.06)	0.08 (0.06)	0.06 (0.06)	0.06 (0.06)	0.03 (0.04)	0.03 (0.04)
Average SES	0.06 (0.04)	0.06 (0.04)	0.07 (0.04)	0.07 (0.04)	0.07 (0.04)	0.05 (0.04)	0.06 (0.04)	0.07 (0.04)
Average age	0.08 (0.03)*	0.09 (0.03)*	0.08 (0.03)*	0.09 (0.03)*	0.08 (0.03)*	0.09 (0.03)*	0.11 (0.03)*	0.12 (0.03)*
Percentage of students with immigrant background	-0.03 (0.04)	-0.04 (0.04)	-0.04 (0.04)	-0.04 (0.04)	-0.06 (0.04)	-0.04 (0.04)	-0.07 (0.04)	-0.06 (0.04)
School level								
Context								
Percentage of girls	0.02 (0.04)	0.01 (0.04)	0.03 (0.04)	0.03 (0.04)	0.02 (0.04)	0.03 (0.04)	0.03 (0.04)	0.04 (0.04)
Average SES	0.05 (0.03)	0.04 (0.03)	0.14 (0.03)*	0.15 (0.03)*	0.08 (0.03)*	0.09 (0.03)*	0.12 (0.03)*	0.13 (0.03)*
Average age	0.03 (0.06)	0.04 (0.06)	0.03 (0.06)	0.03 (0.06)	0.03 (0.06)	0.03 (0.06)	0.05 (0.06)	0.04 (0.06)
Percentage of students with immigrant background	-0.05 (0.02)*	-0.04 (0.02)*	-0.05 (0.02)*	-0.06 (0.02)*	-0.07 (0.02)*	-0.06 (0.02)*	-0.11 (0.02)*	-0.10 (0.02)*
Variance components								
School	10.8 %	10.5 %	8.8 %	8.5 %	9.1 %	8.9 %	10.1 %	9.9 %
Class	13.2 %	13.3 %	11.2 %	12.2 %	13.2 %	13.4 %	12.9 %	13.5 %
Student	37.1 %	38.1 %	40.1 %	38.1 %	41.5 %	41.0 %	39.5 %	40.1 %
Explained	38.9 %	38.1 %	39.9 %	41.2 %	36.2 %	36.7 %	37.5 %	36.5 %

* Statistically significant effect at 0.05 level

Table 4.9

Effects (in Cohen's d Values) of SES and Gender on Achievement at the Beginning of the Intervention of Students at the Schools of the Experimental and Control Group per County

	Experimental Group	Control Group
CYPRUS		
SES	0.31	0.29
Gender	0.11	0.10
ENGLAND		
SES	0.28	0.27
Gender	0.12	0.13
GREECE		
SES	0.35	0.36
Gender	0.09	0.08
IRELAND		
SES	0.27	0.28
Gender	0.13	0.14

At a next step, for each group of schools, separate within-country analyses investigating the impact of student background factors on achievement at the end of the intervention were conducted. These analyses revealed that achievement at the end of the intervention was associated with all student background factors apart from age and ethnicity (i.e., prior achievement, SES and gender). The fixed effects of SES on final learning outcomes obtained from each multilevel analysis were then converted to standardised effects or 'Cohen's d' by following once again the approach proposed by Elliot and Sammons (2004). With regard to the *direct effect* of SES on student achievement at the end of the intervention, it was found that, for students in the control group, the effect of SES was bigger than for those in the experimental group (see Table 4.10). By comparing the effect size of SES at the beginning and at the end of the intervention, one can see that the *direct effect* of SES was reduced in the schools of the experimental group in each participating country (see Table 4.10). Further analysis was also conducted to measure the *total effect* of SES in each group of schools by taking into account the fact that SES has an indirect effect on final achievement through its impact on prior achievement. Table 4.10 reveals differences in the *total effect* of SES on achievement between the experimental and the control group. Specifically, in each country, schools which made use

of DASI not only managed to reduce the *direct effect* of SES on final achievement in mathematics, but also had smaller *total effects* of SES on achievement by the end of the intervention. However, by comparing the effect of SES on student achievement at the beginning of the intervention with the *total effect* of SES on achievement at the end of the intervention, one can see that neither a reduction nor an increase was observed in the schools of the experimental group.

Table 4.10

Effects (in Cohen's d values) of SES on Achievement at the Beginning and at the End of the Intervention of Students at the Schools of the Control and Experimental Group per County

	Experimental Group	**Control Group**
CYPRUS		
Effect of SES on initial achievement	0.31	0.29
Direct effect of SES on final achievement	0.24	0.30
Total effect of SES on final achievement	0.32	0.39
ENGLAND		
Effect of SES on initial achievement	0.28	0.27
Direct effect of SES on final achievement	0.22	0.28
Total effect of SES on final achievement	0.29	0.39
GREECE		
Effect of SES on initial achievement	0.35	0.36
Direct effect of SES on final achievement	0.29	0.35
Total effect of SES on final achievement	0.34	0.44
IRELAND		
Effect of SES on initial achievement	0.27	0.28
Direct effect of SES on final achievement	0.20	0.26
Total effect of SES on final achievement	0.28	0.34

Chapter 5: Conclusions and Discussion

In the first part of the final chapter of this thesis, conclusions on the results of the study are provided (in relation to the research questions raised in Chapter 1) aiming to provide a better understanding to the significance and theoretical contribution of the study. In the second part of this chapter, implications for research, policy and practice are drawn. Specifically, the second part of this chapter is split into two sections. In the first section implications for research are drawn, where suggestions for researchers in the field of EER are provided concerning not only the methodological development of measuring equity but also the conducting of further longitudinal and experimental studies to test the generalisability of the findings of the present study. In the second section, implications for developing policies and taking actions to promote equity at both system and school levels are given.

Drawing on the Results of the Study for Providing Answers to the Research Questions

A whole-school intervention using the DASI (Creemers & Kyriakides, 2012) took place in four European countries (Cyprus, England, Greece and Ireland) to promote quality and equity in primary schools. Explicitly, the experimental study undertaken in these four countries attempted to measure the effect of DASI on improving student achievement in Mathematics (quality dimension) and reducing the effect of SES on Mathematics achievement (equity dimension) in schools situated in socially disadvantaged areas.

As regards to first research question raised in Chapter 1 *(Have the participating schools managed to improve the functioning of their school policy for teaching, policy for creating the SLE, and school evaluation (overarching school factors of the dynamic model) while implementing DASI?)* it was found that in each country, schools which made use of DASI managed to improve the functioning of their school factors, whereas the functioning of these school factors remained the same for the schools of the control group. This was due to the fact that schools of the experimental group followed a specific approach for improving the effectiveness and designed explicit action plans that were focused on areas (factors) that were less effective according to the results of the teacher questionnaire given to them by the A&RTeam. Also, this result shows that authentic changes in school policy may come from interventions taking place at the school rather than at the system level and that DASI stimulates a special approach to improvement whereby each party has a specific role in, and expertise that they contribute to, the intervention and thus ownership is

accomplished. This special relationship established between the school and the A&RTeam, reveals the main difference between DASI and other school improvement approaches that follow a top-down approach giving emphasis only to available knowledge that has emerged from educational effectiveness studies and not to the existing problems, situations, professional needs and abilities of the schools' stakeholders (teachers, students, parents).

With reference to the second research question *(What is the impact of DASI on promoting student achievement in Mathematics?)*, the findings of this study provide empirical support to the argument that DASI can have an impact on promoting student learning outcomes. More specifically, the within-country analyses revealed positive effects of DASI in each country since students of schools implementing DASI managed to achieve better results in Mathematics than students of schools in the control group. It is reminded that the effect of DASI on promoting quality has been revealed through national and international experimental studies conducted during the last ten years (see Creemers & Kyriakides, 2015). However, these experimental studies took place in schools that were typical in terms of the socioeconomic background of their students. The study presented in this thesis, took place in different educational contexts since more 40% of the students of the participating schools were coming from low socioeconomic backgrounds. Therefore, it is argued that this study has shown that DASI can be used for promoting quality in schools situated in socially deprived zones.

Concerning the third research question *(What is the impact of DASI on reducing the effect of the socioeconomic background of the students on their Mathematics learning outcomes?)*, the answer seems to be less clear than when considering the impact of DASI on promoting quality. Specifically, it is argued that the use of DASI in schools in socially disadvantaged areas had an effect on the equity dimension of effectiveness when this dimension is measured by looking at the impact of SES. Firstly, at the beginning of the intervention, the impact of SES on student achievement in Mathematics was equally strong in the schools of both groups (experimental and control). It should be noted that the effect size of SES was comparable to what has been reported in relevant meta-analyses (e.g., Sirin, 2005; White, 1982). Though, at the end of the intervention the impact of SES on student achievement ***was found to be smaller in the schools of the experimental group in comparison with the schools of the control group***. These findings indicate that schools in the experimental group became more effective than those of the control group in terms of the equity, as, in these schools, the achievement gap based on SES was smaller, whereas at the beginning of the intervention the achievement gap had been equally large. It should be

highlighted at this point that results of longitudinal studies conducted in different countries revealed that the effect of SES on student learning outcomes gradually increases over time (Gustafsson et al., 2018; Hansen et al., 2011; Sammons, 2008) for various reasons (even beyond those that can be controlled by the schools) and by taking actions to avoid any increase in achievement gaps based on SES might be the first step towards forming a fair educational system. Thus, these results show the significance of the present study in which the experimental schools have managed to reduce the impact of SES on their students' achievement gains in Mathematics when comparing with that of the schools of the control group. It is as well admitted that differences in learning outcomes between different groups of students cannot be completely abolished since these variances can be attributed to hidden mechanisms in society and in this way, the same approach for measuring both quality and equity is used, whereby it is expected to see progress on the part of all students but do not anticipate that all of them will achieve the 'same maximum' results. It should be acknowledged here that DASI was found to have an effect on promoting student learning outcomes and, thus, its impact on equity did not have any negative effect on promoting quality. On the contrary, schools of the experimental group were found to be more effective in terms of both quality and equity.

However, DASI was not found to have an impact on equity when this dimension of school effectiveness was examined by focusing on achievement gap based on gender and on achievement gap based on ethnicity. Based on the results of this study, ethnicity was not found to be associated with students' final achievement. This is the reason why interaction effects between the use of DASI and this specific background variable were not investigated. However, one cannot conclude that ethnicity is not an important predictive variable of students' learning outcomes. As noted in Chapter 3, the measure of ethnicity in this study had some limitations, since it was based on a simple dichotomous distinction (i.e., 0=other, 1=immigrant background). Therefore, the different ethnic groupings in each participating country were not taken into account. Consequently, this limitation might have affected the impact of this variable on students' learning outcomes. Given that much research has demonstrated differences in achievement based on different ethnic groupings especially in English speaking contexts (e.g. some groups of Chinese/Indian outperform White and Black heritage students) (Francis & Archer, 2005; Strand, 2015; Wong, 2015), future studies could investigate the impact of ethnicity on achievement in a more systematic way. In any case, the findings of the present study reveal the importance of measuring equity in terms of the student achievement gaps based on different background factors, rather than only SES, and evaluating the impact of interventions on promoting

equity by using various criteria (Kyriakides, Creemers, & Charalambous, 2019). Consequently, these findings reveal that there is no criterion consistency in measuring equity, especially as policies and actions might be implemented for addressing equity in relation to specific groups of students (in this study, based on their SES) rather than through a more holistic approach that emphasises the fairness of education in terms of all disadvantaged groups of students, in relation to the achievement of specific learning objectives. The fact that DASI was not found to have an effect on reducing student achievement gaps based on gender and ethnicity could also be attributed to the emphasis given on the impact of SES rather than other background factors in the theoretical framework of this intervention. As mentioned in Chapter 2, DASI is a theory-driven and evidence-based approach as it makes use of the dynamic model of educational effectiveness to raise attention not only to promoting quality and equity but also to identifying specific school factors that need to be considered in promoting student learning outcomes. The dynamic model refers to the impact of various student background factors that are unlikely to change, on student achievement (see Chapter 2). Based on this group of factors, a multidimensional approach in measuring equity is used. Nevertheless, the dynamic model gives more attention to why and how SES can have an impact on learning rather than any other background factor (see Kyriakides, Creemers, & Charalambous, 2018). The emphasis on a single background factor (i.e., SES) can be attributed to the fact that the model emerged from research on school effectiveness which has its origins in reactions to early research on equal opportunity, arguing that, after controlling for the impact of SES, nothing is left for the schools to explain variation in student achievement (see Brookover et al., 1979; Rutter et al., 1979). Although meta-analyses of studies investigating the impact of SES did not provide support for this claim, almost all effectiveness studies were concerned with the impact of SES on achievement and gave less attention to the impact of other background factors such as gender and ethnicity. This is not only reflected in the methodology that is used in this field (see Creemers et al., 2010) but also in its attempts to explain why, and under which conditions, background factors such as gender and ethnicity may influence learning (Kyriakides, Creemers, & Charalambous, 2019; Scheerens, 2013). To some extent, this emphasis on the impact of SES in the dynamic model has influenced the design and the content of the handbook given to schools of the experimental group as well as the support given to these schools for addressing equity in terms of SES rather than in terms of any other student background factor. As a consequence, some experimental schools developed policies and actions promoting equal opportunities by considering only the impact of SES. These policies and actions might not

be relevant when it comes to improving equity in terms of other background factors (e.g., gender and ethnicity) that are unlikely to change. For these reasons, the study presented here revealed that *DASI can promote equity in terms of reducing achievement gaps between students coming from different socioeconomic backgrounds and that the intervention had no impact on reducing the achievement gaps between students with differences in two other background variables namely, gender and ethnicity.*

In the next part of this chapter, suggestions for scholars in the area of EER, policy-makers and practitioners on how to promote both quality and equity dimensions in education are provided. Specifically, in the first section, recommendations are made for the development of a methodology concerning the measurement of equity and the examination of factors at different levels associated with this dimension of effectiveness, as well as proposals on conducting longitudinal and experimental studies which can to contribute to the further theoretical and methodological development of research on equity in education. Additionally, suggestions are given regarding the investigation of the relationship between equity as fairness and equity as inclusion for expanding the area of EER and exploring possibilities of combining these two perspectives. In the second section implications for policy and practice for promoting quality and equity at the system and school levels are drawn. The importance of establishing evaluation mechanisms to measure the effectiveness of teachers, schools and educational systems in terms of both dimensions is raised along with the use of these mechanisms to assess specific policies on equal opportunities and identify the extent to which both quality and equity have been improved. A comprehensive policy on promoting equal educational opportunities for different groups of students, by taking into account not only the impact of SES, but also that of other student background factors is also underlined. The use of the *differentiation* dimension of the dynamic model (see Chapter 2) in the utilization of human and material resources in an educational system is also emphasized.

Implications for Research, Policy and Practice

Expanding the Research Agenda on Equity in Education

Throughout the literature review presented in Chapter 2 and through the findings of the present study, there is research evidence indicating the strong impact of student background factors that are unlikely to change, and especially that of SES, on students' achievement gains. This indicates that schools need to support students coming from lower socioeconomic backgrounds to achieve specific learning outcomes by offering them extra

support. Subsequently, schools are expected to take those actions that can lead to the promotion of both quality and equity. By taking this into consideration, scholars in the field of EER could search for appropriate methods that can be used to measure the extent to which teachers/schools/educational systems can promote both quality and equity. During the last decade, studies have been published where researchers elaborated on the methodology concerning the measurement of equity (e.g., Caro & Lenkeit, 2012; Caro et al., 2014; Kyriakides & Creemers, 2011; Lenkeit et al., 2015; Nachbauer & Kyriakides, 2020) which have also revealed the importance of expanding the research agenda around this issue.

Firstly, since EER should not only search for what works in education and why, but also under which conditions and for whom the effectiveness factors have an impact on learning outcomes (Scheerens, 2016), more attention has to be paid on differential teacher and school effectiveness. This reveals the complexity of generating theoretical models of effectiveness as well as the importance of examining equity by investigating whether specific factors are more or less effective for specific groups of students. By questioning for whom a factor is effective, it is implied that a factor might promote learning but it should be also investigated whether it promotes the learning of specific groups of students. In this way, a specific methodology that can be used to evaluate teachers/schools/educational systems in terms of promoting both quality and equity in education can be developed. The present study, demonstrated how an evidence-based and theory-driven approach (i.e. DASI) can be used to achieve this aim at the school level. Researchers in the field of EER could study this area further and identify factors at other levels (i.e. teacher and educational system) associated with the equity dimension.

Secondly, it was argued in Chapter 2 that a group of researchers in psychology, sociology, and economy of education treated quality and equity as competing each other and supported different approaches on how to deal with the "cost" of promoting the one rather the other. This was partly attributed to the fact that the equity dimension was never explicitly defined and consequently there is not enough evidence investigating the relationship between the two dimensions (Kelly, 2012; Kyriakides & Creemers, 2011). The results of this European experimental study revealed that there is no negative relationship between quality and equity and it was found that schools which were effective in terms of quality tend to also be effective in terms of equity (i.e., the impact of SES on achievement in these schools tends to be smaller). Successively, further research is needed to test the generalisability of these findings, especially since some researchers are less optimistic about the impact that education may have on equity (see Strand, 2010).

Thirdly, the findings of the present study showed that DASI can promote equity in terms of reducing achievement gaps between students coming from different socioeconomic backgrounds and that the intervention had no impact on reducing the achievement gaps between students with differences in two other background variables namely, gender and ethnicity. Since there is no criterion consistency in measuring equity, further research is needed to find out whether equity should be treated as a multidimensional construct. Such studies may not only examine equity by looking at achievement gaps based on different background factors but may also search for consistency in terms of the type of learning outcome that is considered each time. It is therefore recognised, as a limitation of this study (also specified in Chapter 3), that it was only possible to measure student cognitive learning outcomes in a single subject (i.e. Mathematics). Effectiveness studies can be also focus on interaction effects of student background factors. For instance, interaction effects between ethnicity and SES can be explored as some ethnic groups of students are found to have lower educational achievement and the poorest progress when they are compared with other ethnic groups of students coming from the same low socioeconomic background (see Kyriakides, 2007; Strand, 2014b). In this way, theoretical models for promoting equity with generic and/or differential factors could be developed (or existing theoretical frameworks could be expanded) to help policy-makers design reform policies and interventions to promote equity adapted to the needs of specific groups of students.

Fourthly, it should be acknowledged that one of the most important elements of an intervention programme is not only the examination of its immediate impact on school policy and on student learning outcomes, but also the investigation of the sustainability of its effects (Datnow, 2005). Sustainability can be defined as maintenance of achieved outcomes and effects of an intervention programme beyond its completion (Antoniou & Kyriakides, 2013). This means that teachers and schools should be able to use the knowledge gained from the intervention programme, even after its completion. Consequently, future research could address issues related to the scalability of interventions. This is mostly important in the case that interventions are using the DASI as the provision of an A&RTeam is a component that make the improvement project more expensive than other school improvement approaches. Drawing on the fact that the intervention in the present study lasted for approximately eight months (limitation that is also identified at the end of Chapter 3), further research on schools using DASI for a longer period of time than a school year may reveal how the roles of school stakeholders and the A&RTeam may change over time. Given that DASI depends on the collaboration

between the school stakeholders and the A&RTeam, it is important to determine whether stakeholders in schools which have used this approach for a long period of time are now able to implement their action plans and improvement strategies with marginal, or even without the need of, substantial support from the A&RTeam. Block (1999) argues that one of the most inspiring tasks of a coaching team is to build local capacity in the school organisation. Therefore, by identifying changes in the role of the A&RTeam and school stakeholders over time, possibilities for scaling up intervention projects based on DASI may also emerge.

Fifthly, longitudinal studies can be conducted to identify changes in the effectiveness status of schools in terms of both quality and equity after the end of the intervention. It is stressed that there are very few studies investigating the long-term effect of schools (e.g., Bressoux & Bianco, 2004; De Fraine et al., 2007; Dimosthenous et al., 2020; Goldstein & Sammons, 1997; Kyriakides & Creemers, 2008; Tymms et al., 2000; Vanwynsberghe et al., 2017) so this research area requires further development for the benefit of both dimensions of effectiveness as well as to contribute to the debate on what schools can offer to society by not simply achieving specific learning outcomes (within one school year) (i.e., short-term effect of schools in terms of quality), but also in promoting quality and equity through the educational opportunities offered to different groups of students over a long period, even throughout the length of compulsory education. Data emerged from this study were collected over the course of only one school year, therefore changes in school policy and the impact of the intervention on the final student outcomes were only identified with respect to this period. A study looking at the impact of a three-year intervention based on DASI on quality of teaching (Kyriakides et al., 2017) reported a small effect of DASI (i.e., d=0.17) during the first year of the intervention but its effect was increased when the intervention was offered for three years (d=0.39). This implies that DASI interventions may not reach an optimal point where it can have no further effect when offered for a long period. On the contrary, by offering the intervention for a period of three years, a medium effect of the intervention was identified which reveals the value of the specific approach particularly since most interventions in education have moderately small effects (Scheerens, 2013; Slavin et al., 2011). By calculating the extra impact of DASI on improving teaching during the second year (0.13) and during the third year (0.09), it was shown that even two years after the intervention, teachers employing this approach get almost equal benefits as during the first year. Further research is, therefore, needed to search for the added value of offering DASI for a longer period of time in terms of promoting both quality and equity at the school level. Such research can

also help policy makers develop efficient policies supporting schools to promote quality and equity, including the consideration of issues such as the optimal duration of the intervention (Kyriakides et al., 2017) and the differentiated support that each school may have to receive in implementing DASI for a period of time longer than a school year. It is also acknowledged that the present study investigated the promotion of quality and equity in primary schools in four European countries, but not what is happening to these students after leaving primary education or even later after leaving secondary education. Therefore, research that examines the impact of school-level factors and student background characteristics on post-school destinations and choices is required (Antoniou, 2012).

Sixthly, it should be taken into account that researchers and policy-makers have given considerable attention to organizational capacity in schools, especially in those schools that are facing challenges such as large achievement gaps among different student groups (King & Bouchard, 2011). Many researchers also stress that ensuring capacity for a long-lasting improvement is critical to address challenges of both quality and equity (Stoll, 2009; Stringer, 2013). Capacity building for school improvement is a complex attempt, since it includes the knowledge, skills, and dispositions of not only teachers but also of all school stakeholders. In this study, however, the aspect of capacity building in the participating schools was not examined since this was not part of the main purpose of the study. Nonetheless, future studies may be conducted to investigate this aspect and focus on how schools (and especially schools situated in socially disadvantaged areas) could develop those conditions and processes that support and enhance learning through the management of change in their organization. These studies could demonstrate why an improvement approach has been implemented in a more effective way in some schools than others. At this point it is worth mentioning that the research team of this project in England, conducted a qualitative study investigating the processes of implementing the DASI from the perspective of the practitioners (see Antoniou & Griaznova, 2018; Griaznova, 2020). Therefore, their study provides an in-depth understanding of the teachers' perspectives of the facilitators and barriers they encountered while implementing DASI in schools in England. By understanding the challenges and facilitators that teachers encounter in the course of a school improvement project, it is made more visible how teachers influence the improvement of a school and what amount of effort in put into the improvement project, which is an aspect of DASI that was rarely examined (Savage, 2012).

Lastly, as it was specified in Chapter 2, there are two ways that equity in education can be examined: equity as fairness and equity as inclusion. In the present study, equity is

seen as related with fairness which implies that personal or socioeconomic characteristics should not be obstacles to success in education. Therefore, the research design and analyses took into account this perspective in order to evaluate the impact that schools may have in promoting equity in education. Nevertheless, further research is needed to investigate the association between equity as fairness and equity as inclusion. Such studies may help researchers expand the area of EER and explore whether these two perspectives can be combined by taking also into account the provision of a 'basic minimum standard education' for all (Freeman, 2003) ensuring that the equal rights of all students will prosper in education without undermine the basic rights of some for the sake of benefiting the many (Kelly & Elliott-Kelly, 2018). In this case, clear definitions on the basic minimum learning outcomes should be provided and different methodological approaches other than the use of value-added models should be used for measuring the effectiveness status of schools.

In the next section, suggestions for developing policies and practices at the system (national) and/or school level aiming to promote both quality and equity in education are provided.

Establishing Effective Policies and Practices to Promote Both Quality and Equity in Education

One of the main aims of the dynamic model of educational effectiveness (Creemers & Kyriakides, 2008) was to establish stronger links between EER and improvement of policy and practice (Creemers & Kyriakides, 2006). To achieve this aim, a specific approach to school improvement that makes use of this model and the findings of studies testing its validity (see Table 2.1 of Chapter 2) has been generated, namely DASI (Creemers & Kyriakides, 2012). The added value of using DASI to improve the quality of school policy on teaching and on creating a SLE, as well as the learning outcomes of students, has been shown during the last decade were experimental studies at national and international level were conducted (see Table 2.2 of Chapter 2). Therefore, factors associated with promoting quality in education were identified and suggestions for policy-makers and practitioners on how they can improve their effectiveness were given (see Kyriakides, Creemers et al., 2015; Kyriakides et al., 2017). The present study, has managed to provide additional evidence indicating that DASI can be used to improve quality in schools situated in socially disadvantaged areas. In addition, this is the only study that made use of DASI for promoting equity in primary schools situated in socially disadvantaged areas in the four participating European countries, even though there is still a need for more systematic

work in the area of equity as has been already discussed in the previous section of this part. However, some implications of this study for establishing policies and practices that can promote both quality and equity are elaborated below by taking also into account that international comparative studies raise the attention of policy-makers to the need to promote quality and equity, especially in schools situated in socially disadvantaged areas.

First, it is acknowledged that in most countries, evaluation systems are used only for summative purposes (accountability) and are focused on the quality dimension. However, in order to be able to provide support to policy-makers and practitioners to identify the strengths and weakness of their educational system and schools, formative evaluation mechanisms should be established focusing not only improving the learning outcomes of students, but also on providing a fair education by reducing the impact of the socioeconomic background on students' learning outcomes. These mechanisms should be able to provide empirical data on the functioning of teacher, schools and educational systems and should be able to identify those areas that need improvement. A critical point in the establishment of such evaluation mechanisms is the fact that they should take into account that there is no criterion consistency in measuring equity (based on the findings of the present study; see also first part of this chapter), especially as policies and actions might be implemented for addressing equity in relation to specific groups of students (in this study, based on their SES) rather than through a more holistic approach that emphasises the fairness of education in terms of all disadvantaged groups of students, in relation to the achievement of specific learning objectives. For example, national or school policies and actions promoting equal opportunities considering specific background factors only (e.g., SES and/or ethnicity) might not be relevant when it comes to improving equity in terms of other background factors (e.g., gender) that are unlikely to change. This implies that feedback on equity should be more precise and should indicate in each instance the background factor taken into account in measuring equity.

Second, evaluation mechanisms that are able to identify changes in the effectiveness status of teachers, schools and educational systems over time are necessary since, as already mentioned above, when offering an intervention for a longer period of time one could detect the changes in the impact of background factors (such as SES) on student achievement over time. This recommendation is in line with the claim that value-added approaches are needed in measuring the quality dimension and comparing the contribution that each teacher/school/system makes to student achievement gains rather than comparing schools on the basis of final student learning outcomes. In the case of equity, one can seek for changes over time of the impact that SES or other background

factors have on achievement and compare the changes in individual schools with those in the whole population. In case an increase in the impact of SES is observed at country level, any school with a much smaller increase (or no increase) could still be considered effective in terms of equity.

Third, evaluation mechanisms should be developed on the basis that they can serve both dimensions of educational effectiveness (quality and equity) simultaneously. Nowadays, usually when reform policies on equal opportunities are developed, policy-makers hardly ever examine their impact on promoting quality and almost never do so with respect to promoting equity (which is supposed to be the foremost goal of such policies). This is primarily happening because equity is not explicitly defined and most policy-makers have the notion that by promoting quality, equity may also be achieved. Without testing this assumption, one cannot evaluate reform policies on equal opportunities without looking at their differential impact on specific disadvantaged groups of students. By taking into account the knowledge base of EER and the importance of differentiation, one might expect that these policies would be likely to have a negative impact on equity, especially if disadvantaged groups of students are offered less. In this way the impact of background factors on student achievement may explain a higher percentage of school failure. Obviously to test this argument, evaluation data measuring changes in the effectiveness status of schools (and of the system) in terms of both dimensions (quality and equity) are needed. Such data might also reveal that a specific approach is ineffective with regard to both dimensions (not just for equity) and thus actions to change this policy could be taken. For example, in Cyprus, policies to provide extra support for teachers and schools in socially disadvantaged areas have recently been introduced (Ministry of Education, Culture, Sport and Youth, 2019). Although policy-makers might expect that such policies could contribute to promoting equity, this argument still needs to be tested. This can be achieved by collecting data on changes in the effectiveness status of schools which will made use of this extra support. In this way, the overall effect of this reform policy on promoting quality and equity can be measured as well as schools which were making better use of this policy and managing to promote both quality and equity can be identified. Therefore, specific suggestions on how to improve further this policy could emerge. Consequently, the existence of an evidence-based policy-making approach is required to help policy-makers systematically collect data on both dimensions of effectiveness over a period of longer than one school year and in this way to be able to evaluate reform policies by looking at the impact that the policies may have on improving the effectiveness status of schools.

Fourth, policy-makers in the four countries (i.e., Cyprus, England, Greece and Ireland) participating in the present study were asked before the intervention to indicate the type of actions and/or policies that their state could undertake to promote both quality and equity in schools. The results of this study revealed that in each participating country there was space for promoting equity. Given that longitudinal studies investigating the impact of SES on student achievement also revealed that the impact of SES increased over time (Gustafsson et al., 2018; Hansen et al., 2011; Sammons, 2008) and the same picture emerged from analysing the data of the control group of the present study, it could be argued that current policies are not promoting equity at a satisfactory level. For example, existing policies and evaluation mechanisms on teacher selection may have a negative effect on equity if a country's system is either centralised (i.e. Cyprus and Greece) or decentralised (i.e. England). If more effective teachers are to be appointed to schools which are not situated in socially disadvantaged areas (for several reasons, some of which cannot be directly controlled by the state) the end result would be an observable increase in the impact of SES over time rather than a decrease. For instance, in Cyprus where the educational system is highly centralised, teachers' appointments, transfers and promotions are managed by the Educational Service Commission in cooperation with the Ministry of Education (The World Bank, 2014). Once a teacher is appointed to a school, he/she enters a credit-system list according to which each teacher receives credits based on (a) his/her years of employment, (b) the types of school in which he/she has served (e.g. schools with one teacher, schools with two teachers, schools with three or more teachers) and (c) the distance of the school from the teacher's home (The World Bank, 2014). At the end of each school year, the Educational Service Commission issues a list to enable decisions to be taken about the appointment of each teacher for the next school year. Teachers with more credits on this list have the opportunity to be appointed to their preferred schools. Schools situated in socially disadvantaged areas (i.e. schools with high percentages of students coming from minority ethnic groups/immigrants and/or students with low SES) are the least popular. Consequently, the greatest majority of staff in schools situated in socially disadvantaged areas comprise newly appointed teachers, who are the least qualified to serve in these schools since they do not have the experience of a teacher who has worked in schools for five to ten years. The same procedure is also carried out when appointing and transferring deputy head teachers and head teachers, thus teachers newly promoted to those administrative positions are very likely to serve in schools with high percentages of students from a low socioeconomic background. This appointment system could be considered to be one of the reasons that the educational system in Cyprus does not

promote equity in education since students in these disadvantaged schools, who should be provided with more educational opportunities and more experienced teachers, are, in the end, taught by the least qualified teachers who lack the experience to address the learning difficulties of this group of students. A similar observation can be found in other countries, like England, with a decentralised educational system. Education in England is overseen by the United Kingdom's Department for Education, but local government authorities are responsible for implementing policy on public education and state-funded schools at a local level. The overall direction of a school is usually set by a governing body, which appoints the head teacher, sets the strategic direction of the school, draws up policies and monitors the overall performance of the school. The representatives in the governing body always include the head teacher of the school, elected parents, other members of staff and local authority representatives (Challen et al., 2008). Consequently, the governing body of each school is responsible for the selection of the teaching staff. Governing bodies in privileged areas have the opportunity to provide better working conditions for teachers and therefore attract highly qualified teachers. On the other hand, schools in socially deprived areas, in which governing bodies are not able to provide good working conditions, are left to recruit the teachers who have less experience. It could be argued that the educational systems in both Cyprus and England are unable to promote equity in schools and this finding could be attributed at least partly to the teacher appointment systems in these countries. According to the results of a European study conducted in six countries (Belgium/Flanders, Cyprus, Germany, Greece, Ireland and Slovenia), effective teaching is an important aspect of reducing the achievement gap (Panayiotou et al., 2014; Vanlaar et al., 2016). Nye et al. (2004) also found that qualified teachers were especially beneficial for students coming from disadvantaged families. This demonstrates the importance of placing the most effective teachers in schools with the highest percentage of underachieving students, and thus, policy-makers should encourage effective teachers to teach in low-achieving schools by providing them with good working conditions and financial resources. Therefore, when designing policies to promote equity, policy-makers should make use of the differentiation dimension of the dynamic model and exploit the human resources of their educational system in an effective way.

Fifth, policy-makers need to design effective policies on the provision of sufficient learning resources to schools. In a study conducted in Cyprus aiming to investigate the association between educational expenditures and student learning outcomes, it was found that changes in educational expenses had a positive effect on improving the effectiveness status of a school if these expenses occurred in the least effective schools (usually schools

with high percentages of students with low SES) and not in other types of schools which are typical and most effective (see Kyriakides, Stylianou, & Eliophotou Menon, 2019). Thus, financial support to schools, provision of learning materials and other resources (that are decided by the ministry/respective authorities of a country) should not be provided on an equal basis (e.g., funds allocated based on the number of students in a school at the beginning of each school year) since this action might lead in widening the achievement gap between the different groups of students. This is due to the fact that many of the schools situated in privileged areas often receive additional financial support from other sources, such as the students' families and the community, whereas schools situated in disadvantaged areas have no other resources and most of them require extra funding to be able to support students with financial difficulties and other problems. Schools that enrol large proportions of students coming from low-SES backgrounds appear to have a number of challenges in improving student performance and they are not always equipped well enough to address them (OECD, 2018a, 2018b). These schools often lack resources, including equipment and qualified teachers (OECD, 2016a). Consequently, policy-makers need to take targeted measures to compensate for the specific difficulties and differentiate their policies by offering greater and more efficient support to those who need it most. For example, one might reconsider the re-allocation of funding in schools by providing more financial support to those schools who need it more. Access to extra educational staff (such as psychologists, social workers or other professional specialists), provision of professional development opportunities, and designing of effective extra-curricular activities are also actions that can be taken by policy-makers to support these schools (see also European Commission/EACEA/Eurydice, 2020). In any case, appropriate monitoring and evaluation should take place to examine the appropriateness and effectiveness of each action/policy (Verelst et al., 2020).

Sixth, by taking into account that DASI was not found to have an impact on equity when this dimension of school effectiveness was examined by focusing on achievement gap based on *gender* and on achievement gap based on *ethnicity*, policy-makers should understand that there is no criterion consistency in measuring equity and therefore this dimension of effectiveness could be treated as a multidimensional concept. Taking into account that this finding might have emerged due to the fact that the present study was focused on the impact that the SES (rather than gender and ethnicity) has on student learning outcomes and consequently actions included in the handbook provided to schools of the experimental group have concentrated on addressing equity in terms of SES (see also first part of this chapter), educational policies should have in mind that they need to

differentiate their policies when it comes to improving equity in terms of different background factors that are unlikely to change. For example, by taking into consideration that gender disparities in achievement concern the international evaluation studies over time since girls outperform boys in Reading whereas boys outperform girls in Mathematics on average across the European countries (OECD, 2015, 2016b, 2020), school stakeholders could differentiate their actions in various aspects of their school policy, such as quality of teaching and provision of learning opportunities.

As a final point, the impact of DASI on promoting quality and on promoting equity (in at least one dimension i.e., the reduction of the achievement gap in terms of SES) provides support to the argument that authentic changes designed to improve equity come from interventions taking place at the school level. The use of DASI encourages a multi-treatment approach to improvement, whereby each party has a specific role in, and contributes expertise to, the intervention and so ownership is guaranteed. The relationship established between the school's stakeholders and the A&RTeam suggests the main difference between DASI and other school improvement approaches that follow a top-down approach, giving emphasis only to available knowledge that has emerged from educational effectiveness studies and not to the existing problems, situations, professional needs and abilities of teachers, students and parents. Therefore, DASI can be used by stakeholders, especially when it is necessary to deal with improving the effectiveness status of schools situated in disadvantaged areas, since these schools have to face problems that require special attention and handling according to their context. It should be stressed that policy-makers have to bear in mind that since DASI is not a top-down approach, it can be implemented only by schools that are willing to change. Thus, if educational authorities would like to implement such an approach at the system level in an obligatory basis, they should bear in mind that they will have to find their own ways in order to achieve the implementation of DASI in all schools (Alexandrou, 2013). Policy-makers should be also able to support all schools in implementing such an approach by providing them with all the necessary learning resources. This includes, in particular, an A&RTeam that can help them identify improvement priorities, and then design, implement and evaluate school improvement strategies and action plans that take into account the knowledge base of school effectiveness research. However, one could raise concerns on the implementation of such an approach when bearing in mind its financial cost, especially since the presence of an A&RTeam is required. Studies investigating the sustainability of interventions based on DASI (see previous section of this part) for a long period of time might shed light on whether schools are able to implement their action plans and improvement strategies with

marginal, or even without the need of, substantial support from the A&RTeam (and in this case the financial cost of such intervention will be significantly reduced).

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Appendix A: The Teacher Questionnaire for Measuring School Level Factors

SURVEY OF PRIMARY SCHOOLS

Dear Colleague,

The [name of institution] is carrying out research investigating school policy and looks at the relationship between school policy and school improvement. This research is being carried out in a number of schools around the country and in other European countries. We would appreciate it if you could find the time to complete this questionnaire. Your views are very important, as they will inform future policies to assist students, parents/guardians and school staff. All the information you give will be strictly **confidential** and will be used for research purposes only.

This study examines teachers' opinion regarding:

A. Making good use of teaching time:
School policies and systems are reviewed in relation to: management of time, student absenteeism, teacher absenteeism, homework assignment and school time-table scheduling.

B. Provision of learning opportunities:
School policies and systems are reviewed in relation to: the achievement of specific goals set by the school, use of visual material and technological equipment in teaching, working with students who have special educational needs (e.g. gifted children, children with learning difficulties), and long-term planning.

C. Quality of teaching:
School policies and systems are reviewed in relation to: student evaluation, structuring of lessons, orientation of students in achieving specific goals, application exercises, posing and using questions in teaching, use of learning strategies, time management, and the classroom learning environment.

Your views about policies on the broader learning environment of your school will also be examined. Four aspects of the **School Learning Environment (SLE)** will be explored:

- policy on student behaviour outside the classroom
- teacher collaboration
- relationships with parents/guardians and the wider school community
- use of educational resources

Many thanks for taking the time to fill in this questionnaire.

PART A: THE FORMATION OF SCHOOL POLICY AND THE LEARNING ENVIRONMENT OF THE SCHOOL

Part A is comprised of statements concerned with practices that may occur in your school. After reading each statement carefully, circle the appropriate number:

1: if you strongly disagree with the statement
2: if you disagree with the statement
3: if you agree with the statement
4: if you strongly agree with the statement

		Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**
Q1.	Whole school records are kept concerning:				
	a. Student absenteeism	1	2	3	4
	b. Teacher absenteeism	1	2	3	4
	c. The different educational needs of individual students	1	2	3	4
	d. Long-term planning by teachers	1	2	3	4
	e. Organization of trips, visits and other extra-curricular activities not included in the formal curriculum	1	2	3	4
	f. Problems that arise among students during break time	1	2	3	4
	g. The use of educational resources for teaching supplied by the school (e.g. maps, software, internet etc.).	1	2	3	4
Q2.	Our school participates in programmes / projects (e.g. Erasmus, action research projects, collaboration with other schools, pilot initiatives) that focus on:				
	a. Making good use of teaching time	1	2	3	4
	b. Providing learning opportunities beyond those offered by the formal curriculum	1	2	3	4
	c. Improving the quality of teaching	1	2	3	4
	d. Student well-being (e.g. resilience, mindfulness)	1	2	3	4
Q3.	Our school takes into consideration the professional experience, skills and aptitudes of each individual teacher in designing and implementing our **school policy/policies for teaching.**	1	2	3	4
Q4.	The school management team acknowledges (formally/informally) teachers who make extra efforts in implementing our school **policy/policies for teaching** (e.g. making good use of time)	1	2	3	4

		Strongly Disagree	Disagree	Agree	Strongly Agree
Q5.	At staff meetings we discuss and take decisions on issues concerned with:				
	a. Making good use of teaching time	1	2	3	4
	b. Provision of extra learning opportunities in addition to those offered by the formal curriculum (e.g. extra-curricular activities, festivals, fairs, school trips, clubs)	1	2	3	4
	c. Methods to teach students effectively (e.g. structuring lessons, questioning, application, student assessment etc.)	1	2	3	4
	d. Teacher's role during break time	1	2	3	4
	e. Developing positive relationships between teachers and children	1	2	3	4
	f. Promoting positive behaviour among students inside and outside the classroom	1	2	3	4
	g. How we can connect with the local community in order to enrich teaching and extracurricular activities	1	2	3	4
	h. Ways in which parents can be involved in promoting learning at school and home.	1	2	3	4
Q6.	Our school encourages teachers to increase collaboration with parents/guardians of children who require additional educational support.	1	2	3	4
Q7.	Teacher engagement in implementing **policy on improving the school learning environment** (e.g. running the library, teaching choir) is acknowledged (formally/informally) by the school management team.	1	2	3	4
Q8.	Our school takes into consideration the professional skills of each individual teacher in designing and implementing school policy for **school learning environment**.	1	2	3	4
Q9.	The teachers in our school cooperate with each other by exchanging ideas and materials when teaching specific units or series of lessons.	1	2	3	4
Q10.	Teachers observe each other teaching as a way to discuss and share opinions on effective teaching.	1	2	3	4
Q11.	When supervising students on playground, teachers are encouraged to interact with children who may require support (e.g. children who are upset, isolated or display challenging behaviour).	1	2	3	4

		Strongly Disagree	Disagree	Agree	Strongly Agree
Q12.	I feel that I am positively influenced by staff meetings/planning days in relation to:				
	a. Management of teaching time	1	2	3	4
	b. Dealing with student absenteeism	1	2	3	4
	c. Planning, assigning and evaluating homework	1	2	3	4
	d. Making good use of teaching time spent on activities outside of the formal curriculum (e.g. rehearsals)	1	2	3	4
	e. Using of visual aids and technology in teaching (e.g. iPads, computers/laptops, interactive whiteboard)	1	2	3	4
	f. Working with students who have been identified as having special educational needs (e.g. gifted and talented children, children with learning difficulties)	1	2	3	4
	g. Implementing approaches to effective long-term planning	1	2	3	4
	h. Increasing teacher interaction with students during break time	1	2	3	4
	i. Evaluating student performance	1	2	3	4
	j. Structuring of lessons during teaching (e.g. calling attention to main points, linking a lesson with previous or next lessons etc.)	1	2	3	4
	k. Emphasizing learning orientation (i.e., exploring why a lesson/unit is being taught with the students)	1	2	3	4
	l. Using tasks/activities to help students apply their learning (i.e., giving them tasks which apply the concepts taught to a situation in everyday life)	1	2	3	4
	m. Using effective questioning techniques	1	2	3	4
	n. Encouraging the use of learning strategies (e.g. mind mapping, brainstorming, etc.)	1	2	3	4
	o. Improving the learning environment of the classroom (e.g. promoting interaction among students, dealing with misbehaviour).	1	2	3	4
Q13.	Our school has formed a **specific** policy for promoting positive student behaviour during break time.	1	2	3	4
Q14.	In our school, we organize fun activities during break time that may help students to achieve specific learning goals (e.g. games, dance, sports).	1	2	3	4

		Strongly Disagree	Disagree	Agree	Strongly Agree
Q15.	We take into account research findings (e.g. recently published articles in education journals, results of research studies, national policy documents) when we (re)formulate school policy related to:				
	a. Making good use of teaching time	1	2	3	4
	b. Provision of learning opportunities	1	2	3	4
	c. Quality of teaching	1	2	3	4
	d. Parental involvement	1	2	3	4
	e. Teacher collaboration	1	2	3	4
	f. Use of resources for teaching	1	2	3	4
	g. Student behaviour outside the classroom.	1	2	3	4
Q16.	Discussions at staff meetings/planning days help me to improve my practice in:				
	a. Making effective use of teaching time	1	2	3	4
	b. Providing learning opportunities to students beyond those offered by the formal curriculum	1	2	3	4
	c. Classroom teaching	1	2	3	4
	d. Supervising students during break time	1	2	3	4
	e. Using a variety of educational resources	1	2	3	4
	f. Collaborating with parents/guardians to improve teaching and learning.	1	2	3	4
Q17.	At staff meetings we make decisions on how parents/guardians can be involved in learning activities.	1	2	3	4
Q18.	Our school encourages students to develop conflict resolution skills through peer mentoring activities.	1	2	3	4
Q19.	During break time, teachers spend more time with students who face learning difficulties than with other students.	1	2	3	4
Q20.	Parents/guardians are informed about the teaching practices adopted by their child's teacher.	1	2	3	4
Q21.	Discussions at staff meetings lead to an improvement in the way in which the school facilitates teachers for professional development and training.	1	2	3	4

		Strongly Disagree	Disagree	Agree	Strongly Agree
Q22.	Teachers in our school are encouraged to participate in training (e.g. workshops, seminars, mentoring programmes) that:				
	a. Aims to improve specific teaching skills	1	2	3	4
	b. Is cumulative (e.g. involves multiple sessions over a period of time).	1	2	3	4
Q23.	Parental/guardian role in relation to the following is discussed in parent/guardian-teacher meetings:				
	a. Reducing student absenteeism	1	2	3	4
	b. Supervising homework	1	2	3	4
	c. Supporting the needs of pupils with special educational needs (e.g. gifted children, children with learning difficulties, children with special interests).	1	2	3	4
Q24.	There is material on notice-boards in the school relevant to:				
	a. Effective use of teaching time (e.g. reminders regarding punctuality for teachers and students)	1	2	3	4
	b. Provision of learning opportunities beyond those provided by the formal curriculum	1	2	3	4
	c. Characteristics of effective teaching	1	2	3	4
	d. The effective use of a range of educational resources for teaching.	1	2	3	4
Q25.	In our school, there is an opportunity for different groups/people outside the school to become involved with, and cooperate in, the **learning process** (e.g. collaboration between a local basketball player and teachers).	1	2	3	4
Q26.	Our school invites specialists in to conduct in-service training for teachers (e.g. a workshop supporting development of an anti-bullying policy).	1	2	3	4
Q27.	The management team in our school (principal and deputy heads) organizes in-service seminars or workshops to address needs of ***specific groups of teachers*** (e.g. newly qualified teachers, learning support teachers) as required.	1	2	3	4

		Strongly Disagree	Disagree	Agree	Strongly Agree
Q28.	Student performance results are used to develop the school's educational goals.	1	2	3	4
Q29.	Our school designs effective forms of school-to-home and home-to-school communications about school programmes and children's progress.	1	2	3	4
Q30.	The management team in our school makes sure that the professional development activities of teachers are in accordance with the teaching goals of the school.	1	2	3	4
Q31.	In our school we provide a replacement for the absent teacher on time when the class is not held.	1	2	3	4
Q32.	In our school we take care that new technologies that are available to us are used to satisfy our educational goals.	1	2	3	4
Q33.	In our school, we additionally analyse the aspects of the school in which we encounter problems.	1	2	3	4
Q34.	In our school there is a practice that teachers who attended a seminar transfer their knowledge to other teachers.	1	2	3	4

PART B: EVALUATION OF SCHOOL POLICY

Section B is comprised of statements concerned with the evaluation of school policy. After reading each statement carefully, circle the appropriate number:

1: if you strongly disagree with the statement
2: if you disagree with the statement
3: if you agree with the statement
4: if you strongly agree with the statement

		Strongly Disagree	Disagree	Agree	Strongly Agree
Q35.	The way the **teaching policy** is put into practice is monitored.	1	2	3	4
Q36.	Information collected during evaluation of school policy on **teaching** is used in improving existing policy.	1	2	3	4
Q37.	Our school regularly reviews and revises **school policy on teaching**.	1	2	3	4

		Strongly Disagree	Disagree	Agree	Strongly Agree
Q38.	Teachers' capacity to implement **school policy on teaching** (e.g. quantity of education, quality of education, provision of learning opportunities for students) is evaluated within the school.	1	2	3	4
Q39.	To evaluate the implementation of the school **policy on teaching**, we collect information from:				
	a. Teachers	1	2	3	4
	b. Students	1	2	3	4
	c. Parents/guardians.	1	2	3	4
Q40.	The monitoring of the implementation of the **teaching policy**:				
	a. Is focused on specific aspects requiring special attention	1	2	3	4
	b. Involves presentation of findings to staff.	1	2	3	4
Q41.	School policy evaluation results are used to pinpoint areas in **teaching** for which we need support and/or further training.	1	2	3	4
Q42.	Staff are presented with the findings from the monitoring of how policies concerned with **teaching** are implemented.	1	2	3	4
Q43.	The principal and/or other members of the school staff monitor the way the policy concerned with the broader school learning environment is put into practice.	1	2	3	4
Q44.	To evaluate the implementation of the **policy on school learning environment**, we collect information from:				
	a. Teachers	1	2	3	4
	b. Students	1	2	3	4
	c. Parents/guardians.	1	2	3	4
Q45.	Teachers' capacity to implement **policy on school learning environment** (e.g. student behaviour outside the classroom, collaboration and interaction between teachers) is evaluated within the school.	1	2	3	4
Q46.	To evaluate **school policy** we examine the extent to which student behaviour during break time has improved.	1	2	3	4
Q47.	Staff are presented with the findings from the monitoring of how policies concerned with the **broader school learning environment** are implemented.	1	2	3	4
Q48.	Our school regularly reviews and revises policies concerned with the **broader learning environment of school**.	1	2	3	4
Q49.	Our school identifies the professional development/further education needs of its teachers.	1	2	3	4
Q50.	Information collected during evaluation of school policy on the **broader learning environment** is used in improving existing policy.	1	2	3	4
Q51.	School policy evaluation results are used to pinpoint areas in **school learning environment** for which we need support and/or further training.	1	2	3	4

		Strongly Disagree	Disagree	Agree	Strongly Agree
Q52.	The monitoring of the implementation of the **school learning environment policy**:				
	a. Is focused on specific aspect requiring special attention	1	2	3	4
	b. Involves presentation of findings to staff.	1	2	3	4

PART C: ABOUT YOU

Put a √ in the appropriate box or fill where necessary:

Q53. Are you male or female?

Male……. ☐ Female……. ☐

Q54. What is your teaching position in this school?

Head Teacher/Principal ……. ☐

Deputy Head Teacher/Deputy Principal ……. ☐

Teacher……. ☐

Q55. How many years have you been teaching at primary school level? (Please count this school year and exclude career breaks)

(a) in this school…….._____years

(b) in other primary schools……_____years

(c) Total……_____years

In the space provided below, please feel free to report anything you consider important for the development and the evaluation of a school policy concerned with teaching and the learning environment of your school.

_____

_____

_____

_____

Thank you very much for your cooperation.

Appendix B: Specification Table for the Teacher Questionnaire for Measuring School Level Factors

School Factors	Items of the Teacher Questionnaire per School Factor
A. School Policy on teaching	
Quantity of teaching	**1a, 1b, 2a, 5a, 12a, 12b, 12c, 15a, 16a, 24a, 31**
Provision of learning opportunities	**1c, 1d, 1e, 2b, 2d, 5b, 5d, 5e, 12d, 12f, 12g, 15b, 16b, 18, 24b**
Quality of teaching	**2c, 3,4, 5c, 12i, 12j, 12k, 12l, 12m, 12n, 12o, 15c, 16c 24c, 30**
B. Policy on the school learning environment	
Student behavior outside the classroom	**1f, 5f, 11, 12h, 13, 14, 15g, 16d, 19**
Collaboration and interaction between teachers for professional development reasons	**7, 8, 9, 10, 15e, 21, 22a, 22b, 34**
Partnership policy	**5g, 5h, 6, 15d, 16f, 17, 20, 23a, 23b, 23c, 25, 26, 27, 29**
Provision of sufficient learning resources	**1g, 12e, 15f, 16e, 24d, 32**
C. Evaluation of the school policy on teaching	**28, 33, 35, 36, 37, 38, 39a, 39b, 39c, 40a, 40b, 41, 42, 49**
D. Evaluation of the school learning environment	**33, 43, 44a, 44b, 44c, 45, 46, 47, 48, 50, 51, 52a, 52b**

Grade 3 Mathematics Test

Name: ……

School: ……

Class: …… Date of testing: ……

Date of birth: …… Girl ☐ Boy ☐

GUIDELINES: Below you can find 11 questions. You have 40 minutes to do as many as you can. If you cannot do a question, move on. If needed, you can show how you get your answer on the page. Please don't rub out anything.

1) Write the value of digit TWO (2) in each number below.

a) 6**2**7 ……

b) **2**95 ……

2) How much money is here? ☐

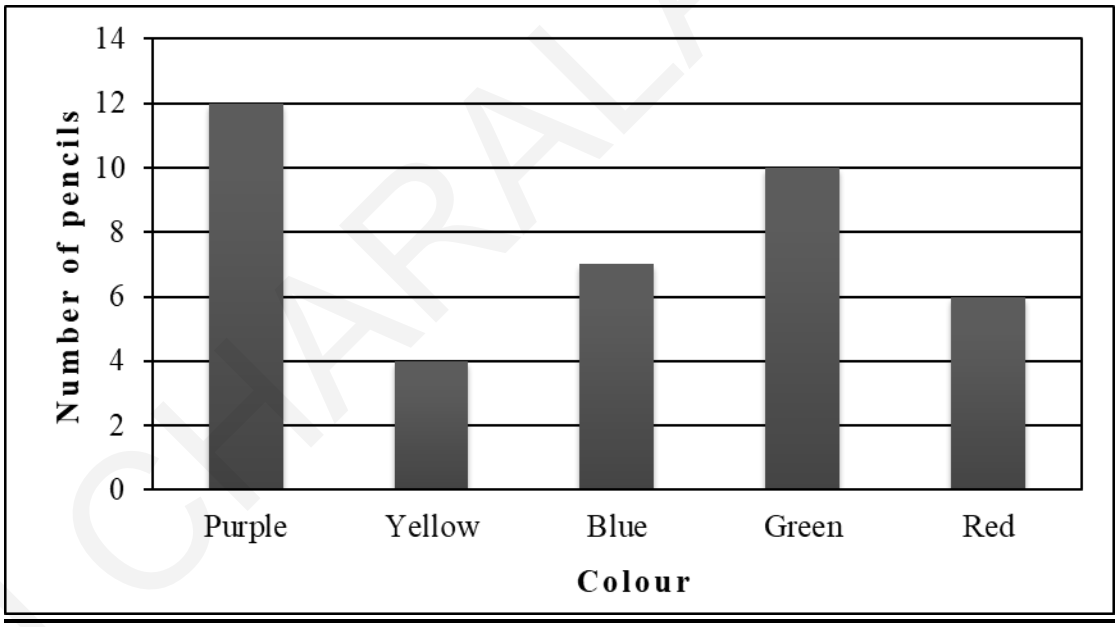
3) Find the answers.

423 + 335	287 + 335	823 - 467

72 ÷ 3 =

52 x 3 =

4) Look at the graph that shows different coloured pencils in a box.



a) How many **green** pencils are there?

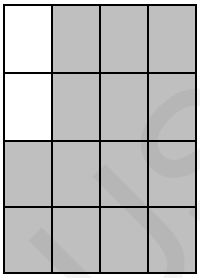
b) How many **more green** than **blue** pencils are there?

5) Circle only the shapes where $\frac{1}{8}$ *is white.*

(a)

(b)

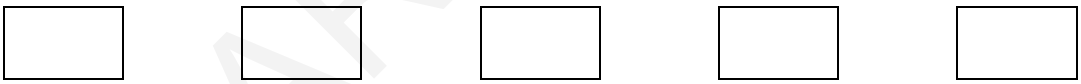
(c)



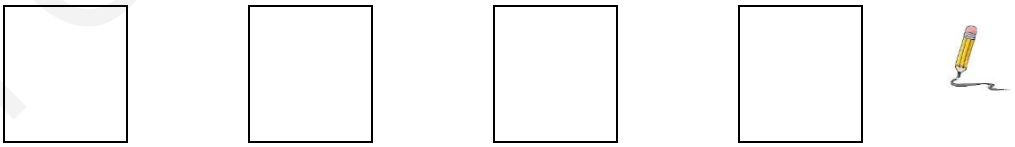
(d)

6) Write the numbers in order from the smallest to the biggest.

a. **183** **703** **1000** **654** **645**



b. $\frac{1}{3}$ $\frac{1}{5}$ $\frac{1}{8}$ $\frac{1}{4}$



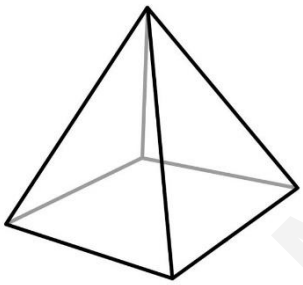
7) Complete the following sentences.

A flat shape (2D shape) has four sides and four right angles. Each side is 5 cm.

The shape is called ……

Its perimeter is ……

8) This is a pyramid.



a) How many **vertices** does it have? ☐

b) How many **faces** does it have? ☐

9) Complete the table.

2 m =	……. cm
€ 3 =	……. cents
500 g =	……. kg
5 hours =	…… minutes

10) Solve the problems below.

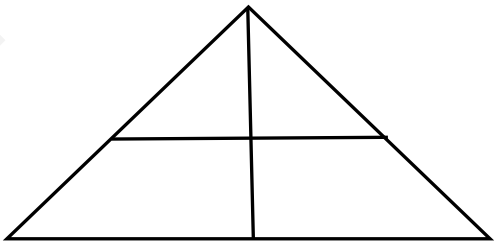
a) There are 157 boys and 146 girls in a school. How many children are there altogether?

Answer: 

b) Mary had €10. She bought 3 notebooks which cost 50 cents each. How much change did she get?

Answer: 

11) Look at the shape below. How many triangles can you see?



Answer: 

Thank you very much!

Grade 4 Mathematics Test

Name: ……

School: ……

Class: …… Date of testing: ……

Date of birth: …… Girl ☐ Boy ☐

GUIDELINES: Below you can find 13 questions. You have 60 minutes to do as many as you can. If you cannot do a question, move on. If needed, you can show how you get your answer on the page. Please don't rub out anything.

1) Write the number.

a) One thousand and thirty seven ☐

b) Three thousand and six hundred three ☐

2) Write the value of the digit TWO (2) in each number below.

a) 6**2**7 ……

b) **2**95 ……

c) **2**534 ……

3) Find the answers.

7 859 + 438	8.23 - 4.67	7 272 - 5 328

210 | 7

52 x 3 =

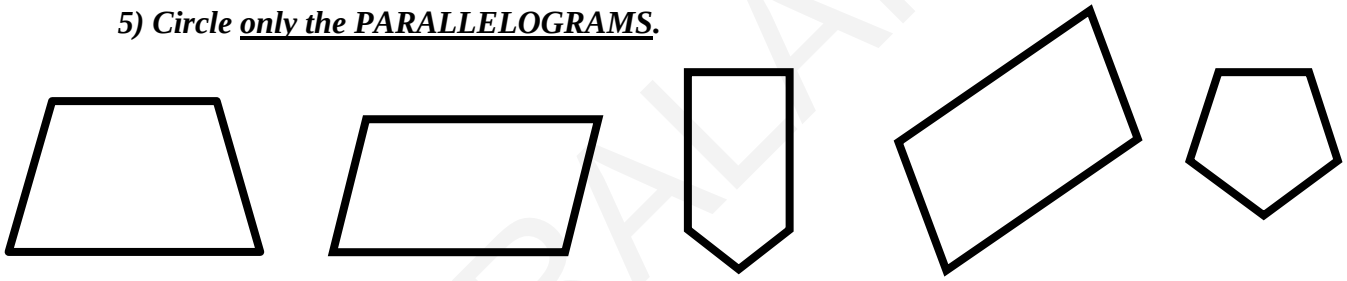
67 | 2

4) Complete the missing numbers in the boxes.

a) 397 — ☐ = 163

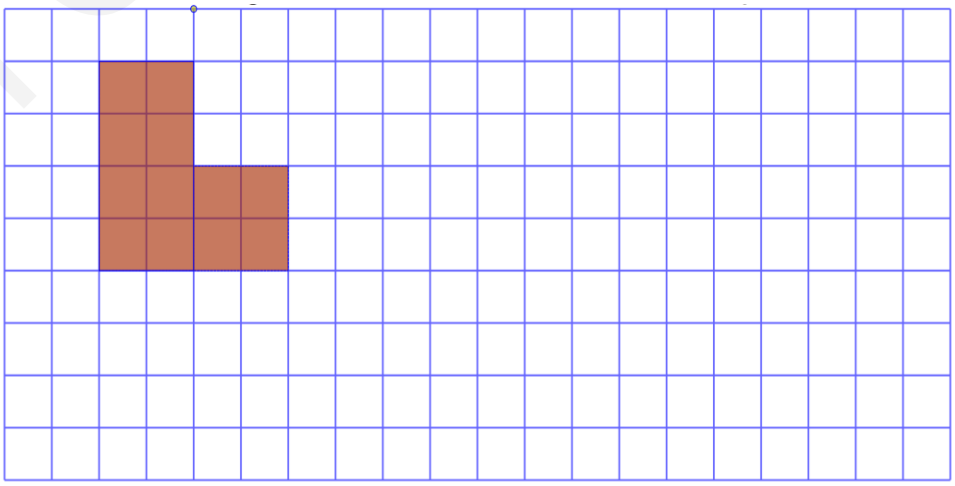
b) 14 x 5 = (10 x 5) + (☐ x 5)

5) Circle <u>only the PARALLELOGRAMS</u>.

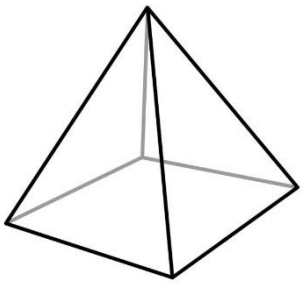


(a) **(b)** **(c)** **(d)** **(e)**

6) Draw a rectangle with the same area as the shape below.



7) This is a pyramid.



a) How many **vertices** does it have? ☐

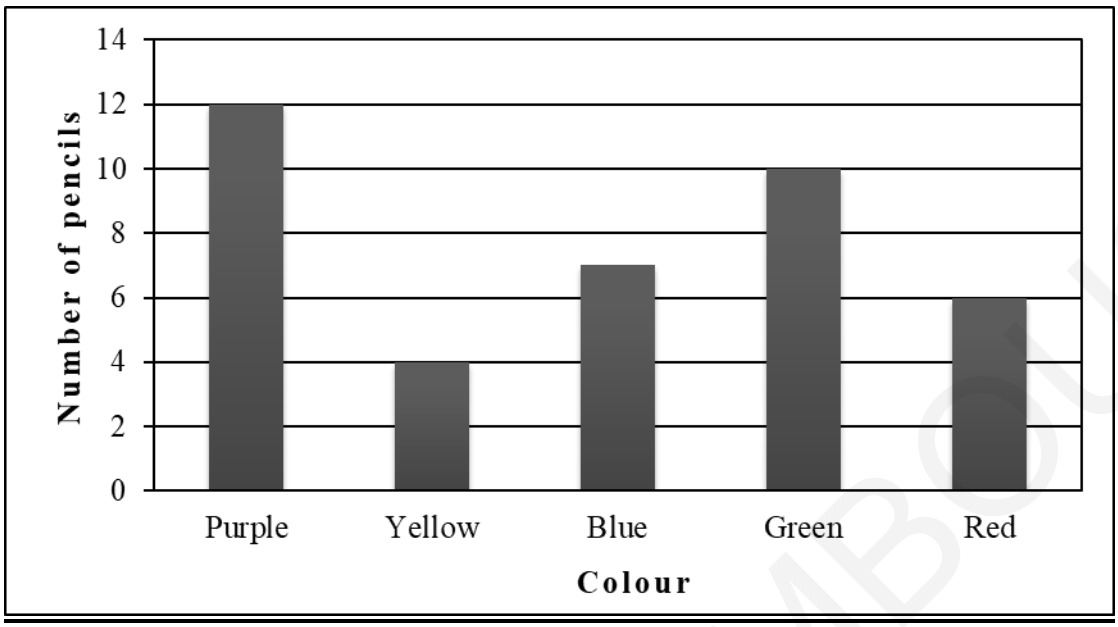
b) How many **faces** does it have? ☐

8) Complete the following sentences.

a. A flat shape (2D shape) has four sides and four right angles. Each side is 5 cm.
The shape is called ……
Its perimeter is ……

b. A flat shape (2D shape) has four right angles. The opposite sides are parallel to each other. One of its sides is equal to 12 cm and another side is 15 cm.
The shape is called ……..
Its perimeter is ……

9) Look at the graph that shows how many pencils are in a box.



a) How many **green** pencils are there? ☐

b) How many **more green** than **blue** pencils are there? ☐

10) Write the numbers in order from the smallest to the biggest.

a) **183** **703** **1000** **654** **645**

☐ ☐ ☐ ☐ ☐

b) $\frac{1}{3}$ $\frac{1}{5}$ $\frac{1}{8}$ $\frac{1}{4}$

☐ ☐ ☐ ☐

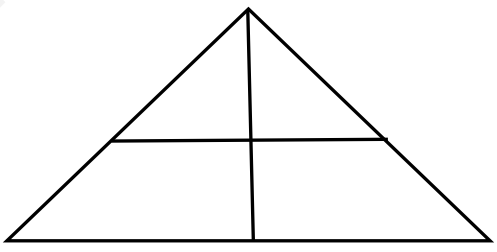
c) **2.15** **2.7** **20.7** **2.09**

☐ ☐ ☐ ☐

11) Complete the table.

2 m =	…… cm
€3 =	…… cents
300 m =	…… km
5 hours =	…… minutes
1 750 g =	…… kg

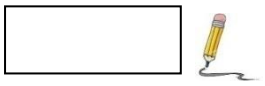
12) Look at the shape below. How many triangles can you see?



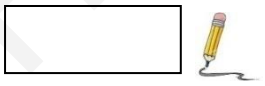
Answer: ☐

13) Solve the problems below.

a) Mary had €10. She bought 3 notebooks which cost 50 cents each. How much change did she get?

Answer: 

b) John saved €150 in September, €80 in October and €133 in November. During Christmas he spent €100 on new clothes and €35 on games. How much change does John have left?

Answer: 

Thank you very much!

Grade 5 Mathematics Test

Name: ……

School: ……

Class: …… Date of testing: ……

Date of birth: …… Girl ☐ Boy ☐

GUIDELINES: Below you can find 13 exercises and 7 questions. You have 80 minutes to do as many as you can and answer the 7 questions. If you cannot do a question, move on. If needed, you can show how you get your answer on the page. Please don't rub out anything.

1) Round the following numbers to the nearest TEN.

a) 134 ☐ **b)** 1 248 ☐ **c)** 1 897 ☐

2) Round the following numbers to the nearest HUNDRED.

a) 123 ☐ **b)** 1 456 ☐ **c)** 989 ☐

3) Find the answers.

7 859 + 438	32 729 + 13 462	7 272 - 5 328	678 X 4

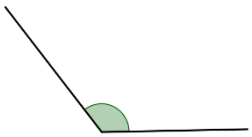
56 X 43	210 | 7	832 | 9

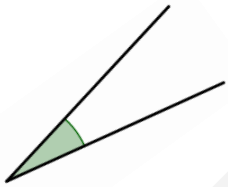
4) Complete the missing numbers in the boxes.

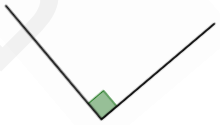
14 x 5 = (10 x 5) + (☐ x 5)

2 x ☐ = 4 x 7 x 2

5) Are the angles below obtuse, right, or acute? (Write your answer in each box)



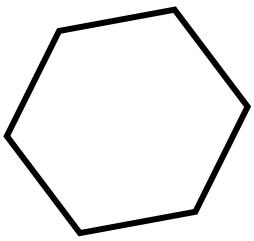




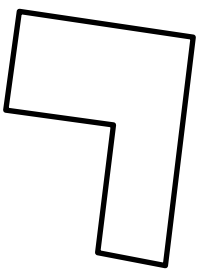
☐ ☐ ☐

6) Circle <u>only the HEXAGONS</u>.

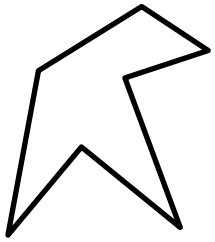
(a)



(b)

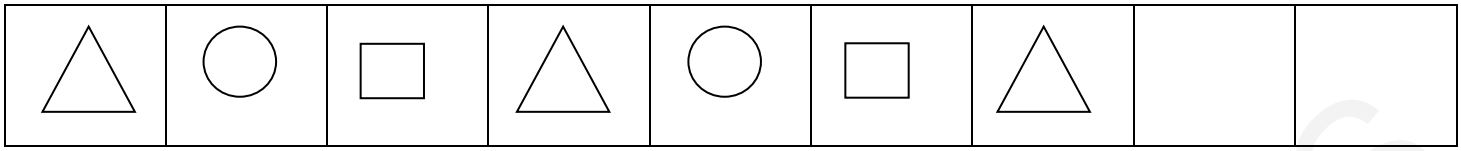


(c)



(d)

7) Draw the next two shapes in the pattern below.



8) Find the next two numbers in the pattern below.

22, 29, 36, ☐ ☐

9) Find:

a. $\frac{1}{3}$ of 36 ☐

b. $\frac{3}{4}$ of 60 ☐

10) Find:

a) $\frac{1}{4} + \frac{2}{4} =$

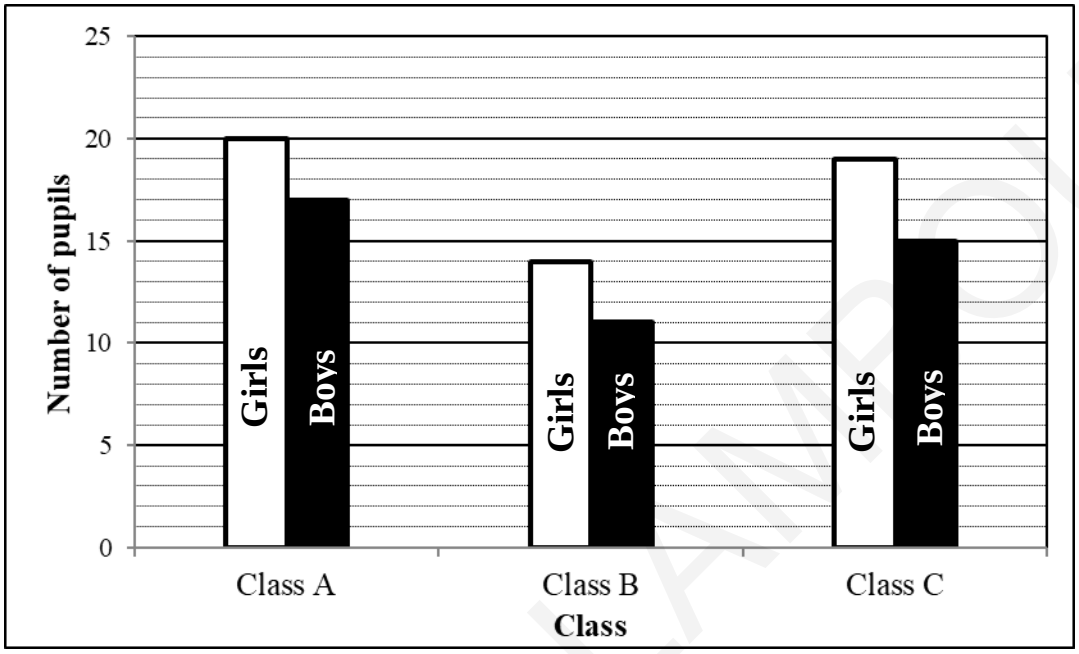
b) $\frac{3}{8} + \frac{1}{4} =$

c) $3\frac{2}{5} - 2\frac{1}{5} =$

d) $3 \times \frac{5}{6} =$

11) Look at the graph that shows the number of boys and girls in Year 4. Answer the questions below.

Boys and girls in Year 4 per class



a) How many **boys** are in class B? ☐

b) How many **more girls** than boys are in class A? ☐

c) How many **children** are in class C? ☐

d) How many **boys** are in Year 4? ☐

12) Complete the table.

2 m =	..... cm
65 ℓ =	..... mℓ
300 m =	..... km
5.3 m =	..... mm
1 750 g =	..... kg

13) Solve the problems below.

a) John saved €150 in September, €80 in October and €133 in November. During Christmas he spent €100 on new clothes and €35 on games. How much money does John have left?

Answer: 

b) Rectangle A and square B have equal perimeters. The length of the rectangle is 8 cm and its width is 2 cm.

The side of square B is ☐

The area of square B is ☐

Thank you very much!

Grade 6 Mathematics Test

Name: ……

School: ……

Class: …… Date of testing: ……

Date of birth: …… Girl ☐ Boy ☐

GUIDELINES: Below you can find 10 questions. You have 60 minutes to do as many as you can. If you cannot do a question, move on. If needed, you can show how you get your answer on the page. Please don't rub out anything.

1) Round the following numbers to the nearest HUNDRED.

a) 1 456 ☐ **b)** 322 348 ☐ **c)** 989 ☐

2) Find the answers.

$$\begin{array}{r} 32\,729 \\ +\ 13\,462 \\ \hline \end{array} \qquad \begin{array}{r} 80\,754 \\ -\ 75\,381 \\ \hline \end{array} \qquad \begin{array}{r} 56 \\ \times\ 43 \\ \hline \end{array}$$

$832 \mid 9$

$8\,486 \mid 42$

$10 + 3 \times 5 =$

$12 \times 2 + 4 \times 6 =$

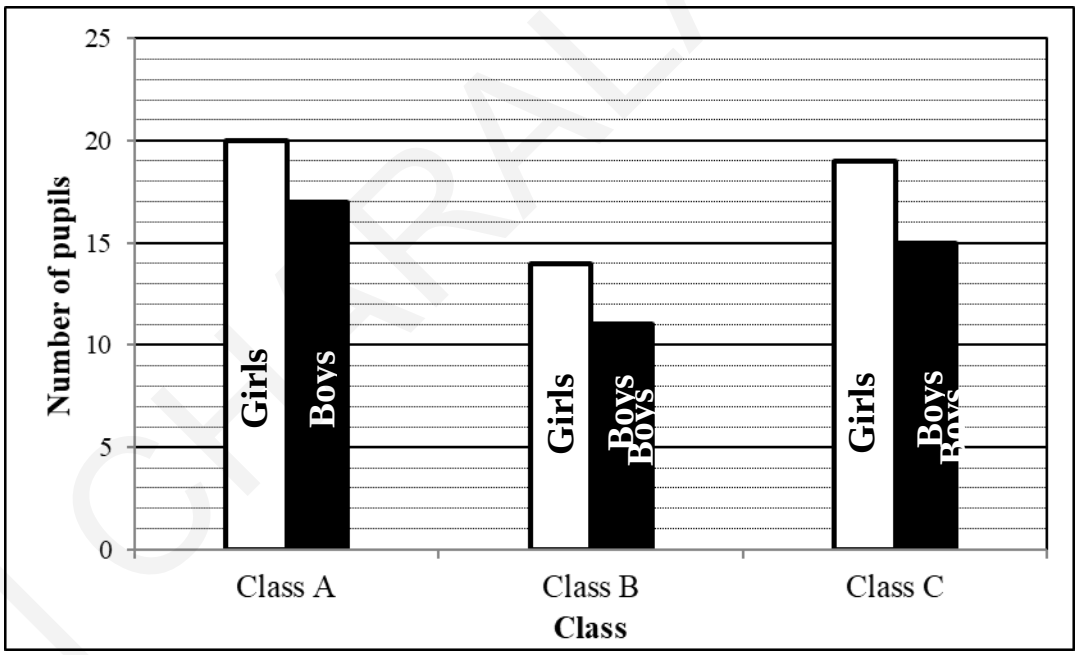
3) Find the next two numbers in each pattern below.

22	**29**	**36**			**a)**

1	**4**	**9**	**16**			**b)**

4) Look at the graph that shows the number of boys and girls in each class of Year 4. Answer the questions below.

Boys and girls in Year 4 per class



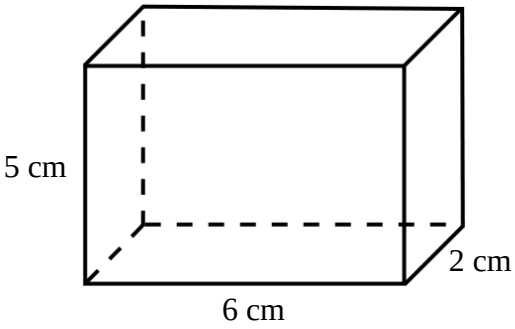
e) How many **boys** are in class B? ☐

f) How many **more girls** than boys are in class A? ☐

g) How many **children** are in class C? ☐

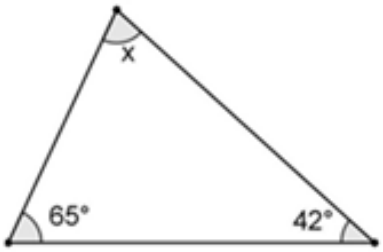
h) How many **boys** are in Year 4? ☐

5) Complete the statement below.



The volume of the cuboid is ☐

6) Find the value of x in the triangle below.



x = ☐

7) Complete the table.

Fraction	Decimal	Percentage
$\frac{1}{2}$	0.5	50%
	0.6	
$\frac{\mathbf{1}}{\mathbf{20}}$		
$\frac{22}{10}$		

8) Find the answers.

a) $3\frac{2}{5} - 2\frac{1}{2} =$

b) $\frac{3}{4} \times \frac{2}{7} =$

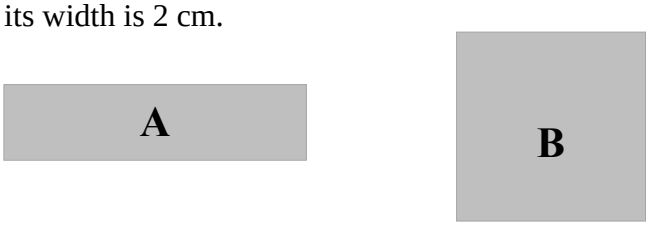
c) $5\frac{1}{3} - 1\frac{1}{6} =$

9) Complete the table.

65 ℓ =	…….… mℓ
300 m =	……..…… km
5.3 m =	……..…… mm
1 750 g =	……..…… kg

10) Solve the problems below.

a) Rectangle A and square B have equal perimeters. The length of the rectangle is 8 cm and its width is 2 cm.



The side of square B is ☐

The area of square B is ☐

b) According to the timetable, bus A and bus B leave the bus station at 7:00 a.m. Bus A leaves the bus station every 20 minutes and bus B leaves every 15 minutes. When will they both next leave the bus station at the same time?

Answer: 

c) A shopkeeper paid €114 for 152 kg of tomatoes and put them in boxes. Each box can hold 8 kg. She sold each box for €9. How much profit did she make?

Answer: 

Thank you very much!

Appendix D: Specification Tables for the Mathematics Tests for Measuring Student Achievement

Specification Table – Grade 3 Mathematics Test

Common Items	Understanding concepts and recalling facts	Performing computations – Algorithms	Solving Problems
Whole Numbers - place value • Compare and order numbers up to 1000. • Recognize the place value of each digit in a three-digit numbers.	1a, 1b 2 3b, 3c, 3d, 3e 6a	2 6a	
Arithmetic Operations Addition and subtraction: • Up to three digits Multiplication and division: • Two-digit numbers times one-digit numbers (short multiplication and division)		3a, 3b, 3c, 3d, 3e	10a, 10b
Fractions • Recognize, compare and order fractions. • Find and write fractions of a discrete set of objects.	5a, 5b, 5c 6b	5d 6b	

Measurement • Measure the perimeter of simple 2-D shapes • Measure, compare, add and subtract: lengths (m/cm) and mass (kg/g) • Money • Time	2 9a, 9b, 9c, 9d	9a, 9b, 9c, 9d	10b
Data - Statistics Interpret: • Bar chart	4a	4b	
Geometry – Shapes (2D) • Describe the properties of 2-D shapes (square, rectangle, triangle)	7a, 7b	7b	11
Geometry – Shapes (3D) Describe 3-D Shapes using accurate language	8a, 8b		
Total number of items	**22**	**15**	**4**
Total number of items: 27			

Specification Table – Grade 4 Mathematics Test

Common Items	Understanding concepts and recalling facts	Performing computations – Algorithms	Solving Problems
Whole Numbers - Place value – Rounding • Order and compare numbers beyond 10000 • Place value of each digit in a four-digit number	1a, 1b 2a, 2b, 2c 3a, 3c, 3d, 3e, 3f 10a	10a	
Arithmetic Operations Addition and subtraction • Up to 4 digits Multiplication and division • Multiply two-digit and three-digit numbers by a one-digit number using formal written layout (short multiplication) • Formal written method of short division • Associative • Distributive		3a, 3b, 3c, 3d, 3e, 3f 4a, 4b	13a, 13b
Fractions and Decimals **Fractions** • Recognize, compare	10b, 10c	10b, 10c	

and order fractions. • Find and write fractions of a discrete set of objects. **Decimals** • Compare and order numbers with up to two decimal places • Addition and subtraction	3b	3b	
Measurement • Convert between different units of measure: ▪ Lengths (m, cm) ▪ Mass (kg, g) ▪ Volume (ml, l) ▪ Time ▪ Money	11a, 11b, 11c, 11d, 11e	11a, 11b, 11c, 11d, 11e	13a
Data – Statistics Interpret bar charts and tables	9a	9b	
Geometry – Shapes (2D) • Recognize and describe 2D shapes (e.g.rhombus, parallelogram, square, rectangle) • Recognize 3-D shapes and describe them • Find the perimeter of a 2D shape • Find the area of rectilinear shapes by countingsquares	5a, 5b, 5c, 5d, 5e 6 7a, 7b 8ai, 8aii, 8bi, 8bii	8aii, 8bii	6 12

Geometry – Shapes (3D) • Describe 3-D Shapes (e.g. Cuboid) using accurate language (i.e. faces, edges)			
Total number of items	**32**	**20**	**5**
Total number of items: 38			

Specification Table – Grade 5 Mathematics Test

Common Items	Understanding concepts and recalling facts	Performing computations – Algorithms	Solving Problems
Whole Numbers - place value - Rounding • Read, write, order and compare numbers to at least 100 000 and determine the value of each digit • Rounding	1a, 1b, 1c 2a, 2b, 2c 3a, 3b, 3c, 3d, 3e, 3f, 3g	1a, 1b, 1c 2a, 2b, 2c	
Operations **Addition and subtraction** • Up to 4 digits **Multiplication and division** • Short and long multiplication • Short division		3a, 3b, 3c, 3d, 3e, 3f, 3g 4a, 4b 13bi	8 13a
Fractions and Decimals Fractions • Compare and order fractions whose denominators are all multiples of the same number • Add and subtract fractions with the same denominator and denominators that are multiples of the same number • Recognize mixed numbers and improper fractions and convert from one form to the other • Multiply proper fractions and mixed numbers by whole numbers Decimals • Read, write, order and compare numbers with up to three decimal places. • Read and write decimal		9a, 9b 10a, 10b, 10c, 10d	

numbers as fractions • Add and subtract decimals			
Measurement Convert between different units of metric measure: units of lengths (km,m,cm,mm), mass (kg, g), volume (l,ml),time, money	12a, 12b, 12c, 12d, 12e	12a, 12b, 12c, 12d, 12e	
Data – Statistics Interpret and present data using appropriate graphical methods (bar charts, pictograms, tables)	11a, 11b, 11c	11a, 11b, 11c	11d
Geometry – Shapes (2D) • Recognize and describe 2D shapes (e.g. rhombus, parallelogram, square, rectangle) • Perimeter (simple 2-D shapes) • Area • Estimate and compare acute, obtuse and right angles • Angle sum facts - deductions about missing angles	5a, 5b, 5c 6a, 6b, 6c, 6d	13bii	7 13bi
Total number of items	**28**	**31**	**5**
Total number of items: 42			

Specification Table – Grade 6 Mathematics Test

Common Items	Understanding Concepts and recalling facts	Performing computations – Algorithms	Solving Problems
Number and place value • Read, write, order and compare numbers and determine the value of each digit Up to 1 000 000 000 • Round any whole number to a required degree of accuracy • Prime numbers and Composite numbers	1a, 1b, 1c 2a, 2b, 2c, 2d, 2e	1a, 1b, 1c	
Arithmetic Operations • Addition, subtraction • Multiply multi-digit numbers up to 2 digits by a two-digit whole number (short and long multiplication) • Divide numbers up to 4 digits by a two-digit whole number (short and long division) • Order of operations	2f, 2g	2a, 2b, 2c, 2d, 2e, 2f, 2g 10ai	3a, 3b 10b, 10c

Decimals, Fractions, Percentages <u>Decimals</u> • Order and compare decimal numbers • Identify the value of each digit in numbers given to three decimal places • Add and subtract decimals • Multiply one-digit numbers with up to two decimal places by whole numbers • Division of decimal numbers by one-digit whole number <u>Fractions</u> • Compare and order fractions (>1) • Add and subtract fractions with the same and different denominators and mixed numbers • Multiply simple pairs of proper fractions • Recognize mixed numbers and improper fractions and convert from one form to the other • Convert decimals to fractions and vice versa • Fractions of a number (for example 2/3 of 12) <u>Percentages</u> • Convert between percents, fractions and decimals • Solve problems involving the calculation of percentages	7a, 7b, 7d, 7e, 7f	7a, 7c 8a, 8b, 8c	

Measurements Use, read, write, solve problems and convert between standard units : ➢ length: km/m/ cm/ mm, ➢ mass: kg, g, ➢ volume/ capacity: l, ml ➢ time ➢ money	9a, 9b, 9c, 9d	9a, 9b, 9c, 9d	10c
Geometry- Shapes (2D-3D) **3-D shapes:** • Recognise and describe 3-D shapes (cube, cone, cuboids, sphere, pyramids) • Area • Volume of cubes and cuboids **2-D shapes:** • Polygons • Classify geometric shapes based on their properties and find unknown angles in any triangles, quadrilaterals • Perimeter • Area • Estimate and compare acute, obtuse and right angles	6	5 6 10aii	10ai
Data • Interpret and present data using appropriate graphical methods (pie charts, bar charts and tables)	4a	4b, 4c	4d
Total number of items	**21**	**25**	**7**
Total number of items: 35			

Appendix E: The Student Questionnaire for Measuring the Socioeconomic Background of the Students

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[The following questions were given to students as an additional part of the written Mathematics test (of each grade), at the end of the intervention (in the final measurement)]

Now that you have finished the exercises, please answer the following seven (7) questions.

1. In your home, do you have? Please <tick> only one (1) box on each row.

	Yes	No
a) A Newspaper		
b) A car		
c) A second car.....		
d) A room of your own		
e) A Lawnmower		
f) Books of your own (except your school books).....		
g) Musical instrument(s) (e.g., piano, violin).....		
h) A computer (PC or laptop) or a tablet.....		
i) An internet connection / WiFi.....		
j) Your own desk to do your homework.....		

2. In what country were you and your parents/guardians born? Please <tick> only <u>one</u> (1) box on each row

	(Test country)	Other country	I do not know
a) You			
b) Mother/Female guardian			
c) Father/Male guardian			

3. Answer the following questions. Please <tick> only <u>one</u> (1) box on each row.

	Yes	No
a) Have you travelled to another country for holidays		

	Yes	No
b) Does your mother/female guardian work?		

If **<u>yes</u>**, please explain what your mother/female guardian does with as many details as possible:

.....

.....

	Yes	No
c) Does your father/male guardian work?		

If **<u>yes</u>**, please explain what your father/male guardian does with as many details as possible:

.....

.....

4. What language do you speak at home most of the time? *Please <tick> only <u>one</u> (1) box on each row.*

a) Test Language..... ☐

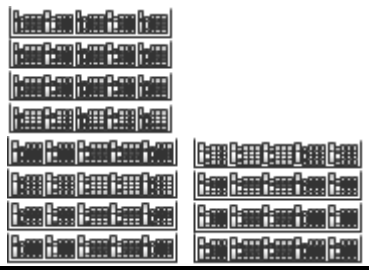
b) Other official national language..... ☐

c) Other national dialects or languages..... ☐

d) Other language(s) not mentioned above ☐

Please list: ……

5. About how many books are there in your home? (Do <u>not</u> count magazines, newspapers, or your school books). *Please <tick> only <u>one</u> (1) box.*

a) None or very few (0-10 books)	☐	This shows 10 books 
b) Enough to fill one shelf (11-25 books)	☐	This shows 25 books 
c) Enough to fill one bookcase (26-100 books)	☐	This shows 100 books 
d) Enough to fill two bookcases (101-200 books)	☐	This shows 200 books 
e) Enough to fill three or more bookcases (more than 200 books)	☐	This shows more than 200 books 

6. Answer the following questions. Please <tick> only <u>one</u> (1) box on each row

My parents/guardians:	Very well	Well	Not at all
a) Know my classmates' parents/guardians			
b) Know the parents/guardians of my friends in the neighbourhood			
c) Know the parents/guardians of the children in any groups I am involved in (such as sports club).			

7. Since last September, how often have you taken part in the following activities? Please <tick> only <u>one</u> (1) box on each row

	Never/ hardly ever	Once or twice a year	About 3 or 4 times a year	More than 4 times a year
a) Went to see a play with my family.				
b) Visited a museum or art gallery with my family.				
c) Attended a popular music concert with my family.				
d) Went to the <pictures/movies> with my family.				
e) Went to a public reading by a writer with my family.				

Appendix F: Sample of Action Plan to Develop Strategies at Schools Aiming to Promote Quality and Equity

ACTION PLAN TO DEVELOP STRATEGIES AIMING TO PROMOTE QUALITY AND EQUITY AT MY SCHOOL	
School Name: **Coordinator Name:** **Time Period:**	
A. Focus of Strategies (put an X):	
Policy for creating the school learning environment (SLE) and actions taken for improving the SLE	
▪ Student behaviour outside the classroom	
▪ Collaboration and interaction between teachers	
▪ Partnership policy (i.e., relations of school with community, parents, and advisors)	
▪ Provision of sufficient learning resources to students and teachers	
School policy for teaching and actions taken for improving teaching practice	
▪ Quantity of teaching (time on task)	
▪ Provision of learning opportunities	
▪ Quality of teaching	
B. Action Plan (describe briefly the following):	
PLAN	**DEVELOP A PLAN**
	a) Brief description of the priority your school has chosen/strategy your school is developing or will develop (in general):
ACT	**IMPLEMENT THE PLAN**
	b) Specifically, at what stage are you concerning your strategy/priority? c) Who is involved at this stage? o in your school (besides yourself): o from outside/from the community (e.g., parents, in-service trainer, counsellors etc.): d) What is your time frame for this?
CHECK	**EVALUATE THE EFFECT OF THE PLAN**
	e) When and how will you evaluate your priority/strategy? o periodically (i.e. once a month): o at the end of the project/school year:
IMPROVE	**CONTINUE OR ADJUST THE PLAN**
	f) As a result of the evaluation, and if it is the case, what needs to be adjusted?

Appendix G: Author's Explicit Role in the Project

This doctoral dissertation presents the results of a three-year European project entitled "Promoting Quality and Equity: A Dynamic Approach to School Improvement (PROMQE)" which has been funded with support from the European Commission. Since four European countries (Cyprus, England, Greece, and Ireland) participated in this project, the contribution of the author of this doctoral dissertation in the aforementioned project is identified in this Appendix. More specifically, the main responsibilities of the author are listed below:

1) Involvement in the development of the research proposal of the project. This included the literature review undertaken during that time-period, the designing of the project's main phases and the cooperation with all partners from all participating countries.
2) After the approval of the research proposal by the European Commission, I was employed as a Special Research Scientist at the Department of Education of the University of Cyprus and therefore I was responsible for the research undertaken in Cyprus. This included:
    a) The sample selection and communication with all schools during all the phases of the project.
    b) The implementation of DASI in the schools of the experimental group (providing guidelines to schools for designing their action plans and providing feedback to them during the intervention, including school visits approximately once every 6 weeks).
    c) The presentations given to the schools of both groups (experimental and control) and the participation in staff meetings.
    d) The data collection from the schools of both groups (using the three measurement instruments mentioned in this thesis) in collaboration with other colleagues from the Department of Education.
    e) The correction of the students' mathematics tests and the entering of the data in collaboration with other colleagues from the Department of Education.
3) Creating a common data base across the four participating countries and conducting all statistical analyses mentioned in this thesis.
4) Development of the handbook given to the schools of the experimental group in collaboration with all country teams.
5) Participation in all transnational meetings and training activities carried out during the whole duration of the project (i.e. three years).
6) Coordination of all communication between the participating organizations.
7) Collaboration with all country teams during the intervention phase, exchange of practices and provision of feedback for implementing DASI.
8) Involvement in the production of the official reports of the project given to the European Commission.
9) Co-author of two research papers published in international scientific journals with a referee system (*Educational Assessment, Evaluation and Accountability; Educational Research*) based on the results of this project.

Appendix H: Examples of Action Plans and Strategies Taken by the Schools of the Experimental and Control Group in Cyprus for Improving their Effectiveness – The Role of the A&RTeam

	The Problem/Challenge	Improvement Strategy and the Role of the A&RTeam
Example 1 (experimental group)	Some parents had to leave their children alone at home after the end of the school day due to fact that they had to work until late in the afternoon. Consequently, they did not have the chance to provide support to their children while doing their homework. These students were also facing serious problems as regards to their overall performance.	The head teacher asked the support of the A&RTeam to help these students during the afternoon hours. A specific policy was established on providing extra lessons to these students. The A&RTeam has formed a group of volunteers Graduate students of the Department of Education of the University of Cyprus to help these students with their homework during the afternoon. Extra learning materials were also provided to these students.
Example 2 (experimental group)	A significant number of students arrived at the school extremely early in the morning since their parents had to go to work (they were workers in factories and they had to be at work very early). These students were left unattended for almost one hour before the school staff arrives at the school. Issues of safety and misbehaviour have also occurred.	The head teacher asked the opinion of the A&RTeam for developing a "club" of teachers for welcoming these students early in the morning. The A&RTeam supported this action and recommended additional activities to be carried out before the lessons begin.
Example 3 (experimental group)	Teachers had to improve aspects of their quality of teaching.	The head teacher asked the support of the A&RTeam in order to explain to the teaching staff what we mean by the term "quality of teaching". The A&RTeam presented the eight effectiveness factors situated at the classroom level of the dynamic model and explained how each one of them can be addressed during a staff meeting.
Example 4 (experimental group)	The parents were experiencing problems on how to support their children while doing their homework.	The A&RTeam provided an explicit presentation to the parents during the afternoon hours in which guidelines on how to support the learning of their children at home were given.
Example 5 (control group)	The library of the school was very poor. The number of the books was also insufficient.	The school received funding from an external source for enhancing the learning resources for students and teachers. The head teacher asked the opinion of the A&RTeam regarding the material and books that can be purchased. The A&RTeam provided a list of books that can be purchased and also a list of resources for all school subjects) that be used by the teachers. A Mathematics software was also bought after the recommendation of the A&RTeam.
Example 6 (control group)	The school faced issues of students' misbehaviour before the lessons start and at the end of the school day. More specifically, incidents of bullying have occurred in the school busses.	The A&RTeam recommended that the head teacher of the school should speak with the bus drivers directly and explain to them about what actions can be taken during the incident. Written guidelines were given to the bus drivers to help them on how to react when bullying occurs.