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Co-funded by the
Erasmus+ Programme
of the European Union

WP2

Development of SpiceE Strategy for STEAM in Special Education

DEV2.1 GAP Analysis

March, 2023

University of Macedonia



University
of Cyprus



Contents

| | |
|--|----|
| <i>Executive summary (EN)</i> | 4 |
| <i>Executive summary (GR)</i> | 8 |
| <i>Executive summary (BG)</i> | 13 |
| <i>Executive summary (SP)</i> | 18 |
| <i>1. Introduction</i> | 23 |
| <i>2. International trends in STEAM Education applications and the situation in the participating countries</i> | 24 |
| 2.1. STEAM Education in the countries participating in the SpiceE project | 29 |
| <i>3. International trends in Inclusive Education of Students with Mild Disabilities and the situation in the participating countries</i> | 33 |
| 3.1. Inclusive education in the countries participating in the SpiceE project | 35 |
| <i>4. Using STEAM Education as a means for the promotion of Inclusive Education of Students with Mild Disabilities and the pivotal role of teachers</i> | 38 |
| <i>5. Pre- and In-service teacher knowledge on and attitudes toward Inclusive STEAM Education for students with Mild Disabilities in the participating countries</i> | 40 |
| 5.1 Pre-service teachers | 41 |
| 5.1.1 Demographics | 41 |
| 5.1.2 Questions addressed only to pre-service teachers | 41 |
| 5.1.3 Questions addressed both to pre-service and in-service teachers | 41 |
| 5.1.4 Conclusions | 43 |

| | |
|--|----|
| 5.2 In Service teachers | 45 |
| 5.2.1 Demographics..... | 45 |
| 5.2.2 Questions addressed only to in-service teachers and referring to their knowledge of STEAM or inclusive programs that were implemented in their educational system, and also their participation in such programs | 46 |
| 5.2.3 Questions addressed both to pre-service and in-service teachers, and referring to knowledge and interest in learning about inclusive STEAM Education, as well as to perceived needs in terms of training | 51 |
| 5.2.4 Conclusions | 53 |
| 6. General conclusions and proposals | 57 |
| 7. Gap analysis..... | 57 |
| 7.1. Justification..... | 58 |
| 7.2. Inclusion of students with Mild Disabilities in STEAM..... | 58 |
| 7.3 Knowledge and skills of pre- and in-service teachers..... | 60 |
| The combination of the GA findings with the competence framework is expected to facilitate the decision making on the educational framework and ultimately to allow the implementation of a productive teacher training program on Inclusive STEAM Education..... | 66 |
| References | 67 |
| Internet resources | 74 |
| ANNEX I | 75 |
| QUESTIONNAIRE | 75 |

Executive summary (EN)

In recent years the interest of the international education community in the promotion of STEAM Education has been considerably increased. This interest has resulted from the belief that STEAM - literate citizens may cope better with present and future life demands than citizens who do not possess STEAM - related knowledge and skills. The transformation of the interest in STEAM Education into concrete school practice is carried out through various measures such as the introduction of STEAM disciplines in the existing school curricula, and the training of teachers in implementing STEAM education activities.

In this context the challenging issue of the education of students with Mild Disabilities acquires new important dimensions. The well – known learning difficulties of these students necessitate the adoption of new instructional solutions that will facilitate their productive participation in STEAM Education activities. Otherwise, the learning distance of students with Mild Disabilities from their classmates without disabilities may become unmanageable. In this regard, the contribution of the SpiceE project may be significant, as its main focus is to present functional solutions for effective teacher training in Inclusive STEAM Education.

In order to achieve the project's main goal, the participating partners conducted a systematic review of STEAM and Inclusive education practices implemented in their countries and also worldwide. Moreover, they investigated the knowledge of pre- and in-service teachers from their educational systems with regard to (a) the present situation of Inclusive STEAM Education in each country, and (b) the conceptualizations of important Inclusive STEAM Education dimensions. Additionally, teacher attitudes preferences were explored in reference to the prospect of participating in specialized training programs focusing on this complex issue. Main results of these research efforts were the following.

(a) With regard to STEAM education:

- Different perspectives and foci about STEAM education and noteworthy diversity even in key notions of the field were recorded both at international and national levels.
- Many STEAM scholars and practitioners seemed to struggle with an integrated approach to Arts.
- The connections among content literacy, reading and STEAM Education, as well as the creation of literacy-embedded STEAM Education programs have gained the

attention of researchers, in an effort to remove the boundaries between traditional academic subjects, such as Liberal Arts, and the STEAM disciplines.

- Implementation of STEAM Education requires the joint effort of numerous agents including policy-makers, government officials, school administrators, and teachers.
- Teachers' perceptions of STEM subjects appeared as having inconsistent relationship to their years of teaching experience and might be mediated by their interest in STEM disciplines.
- Teachers' willingness to implement STEM curriculum was found to be directly affected by their self-efficacy beliefs and the value they place on STEAM Education.
- Lack of quality assessment tools, appropriate curricula, planning time, and knowledge of STEAM disciplines seem to be regarded by many teachers, both internationally and in the SpiceE countries, as important challenges and barriers to STEAM initiatives.
- The importance of appropriate initial and in-service teachers' training as a prerequisite for effective STEAM Education was a common finding of the respective literature review and research.
- All four countries of the SpiceE project were found to be at a phase of intense discussions, explorations, and changes. However, primary students with Mild Disabilities had not been included systematically in the efforts to plan, organize, and implement STEAM education activities.

(b) With regard to inclusive education:

- It is widely theorized that inclusive education should provide a barrier-free learning environment for all learners, regardless of their individual differences, and not be confined to students with disabilities. However, in practical terms most countries continue to understand inclusive education primarily as support for learners with special educational needs and/or disabilities.
- In reference to definitions, assessments, organizational issues, and educational traditions referring to inclusion the situation in the four countries, and also internationally, is characterized by noteworthy diversity.
- Conversion of the theory on Inclusion into concrete school practice is a very challenging task that may be facilitated through the use of clear goals and concrete evaluation criteria in the case of each inclusion program realized in a specific context. This fact is

realized but not put to practice in most countries, including the countries participating in the SpicE project.

- The range of the supports necessary for implementing successful Inclusion in a general classroom may be very wide, due to the diverse student needs. This fact creates frustration among teachers.
- Despite their differences regarding the progress in various parameters of Inclusion, all four countries of the SpicE project are at a phase of intense discussions, explorations, and implementations. A main element of these processes is the recognition of the need for appropriate teacher training in the specifics of Inclusion.

(c) With regard to pre- and in-service teacher knowledge, attitudes and training needs pertaining Inclusive STEAM Education

- The pre- and in-service teachers from the four participating countries reported considerably higher familiarity with the notions and the practices of inclusive education compared to STEAM Education or Inclusive STEAM Education.
- The level of teacher satisfaction from the already implemented STEAM or Inclusive Education programs in their countries was found as rather low.
- Pre- and in-service teachers from the four countries tended to have a fair grasp of several basic theoretical premises of Inclusive STEAM Education, although they also exhibited some false understandings, especially in reference to the importance of certain factors such as the role of the curriculum, the significance of educational assessment, and the need for theoretical documentation of the implemented practices.
- Teachers mentioned the lack of sufficient educational resources and the increased workloads as important factors obstructing the implementation of Inclusive STEAM Education.
- Appropriate training of school teachers was recognized as a powerful agent that might compensate for eventual insufficiencies of other educational factors.
- Pre- and in-service teachers expressed their strong interest in learning about STEAM, Inclusion, and the combination of the two fields.

Although the samples from the four countries participating in SpicE were diverse, their knowledge, attitudes, and perceived training needs in reference to Inclusive STEAM Education converge to a considerable degree. This convergence allowed the realization of a Gap Analysis

(validated by teacher representatives and Associations), that yielded useful information for implementing the next steps of SpiceE. In specific, the Gap Analysis revealed that training of in-service teachers in Inclusive STEAM Education should prioritize the learning goals as follows:

Goals of high importance: practical solutions for inclusion, STEAM in daily school practice, specific methodology for Inclusive STEAM Education, potential of STEAM Education in promoting Inclusion, assurance of student learning progress, assessment of students with mild disabilities

Goals of medium importance: curriculum adaptation, STEAM in integrated classes, theoretical training in STEAM Education

Goals of low importance: specialty in STEAM fields, integrating learning objectives.

In the case of pre-service teachers, the training program should set the following goals:

Goals of high importance: practical solutions for inclusion, specific methodology for Inclusive STEAM Education, theoretical training in STEAM Education

Goals of medium importance: potential of STEAM Education in promoting Inclusion, assurance of student learning progress,

Goals of low importance: STEAM in daily school practice, curriculum adaptation, STEAM in integrated classes.

Obviously, the priorities for each group differ but in essence their training needs are very similar, especially considering the fact that the training program will be wide enough to incorporate many different subjects and skills.

Executive summary (GR)

Τα τελευταία χρόνια το ενδιαφέρον της διεθνούς εκπαιδευτικής κοινότητας για την προώθηση της εκπαίδευσης STEAM έχει αυξηθεί σημαντικά. Αυτό το ενδιαφέρον προέκυψε από την πεποίθηση ότι οι πολίτες με STEAM γραμματισμό, μπορούν να αντιμετωπίσουν καλύτερα τις παρούσες και τις μελλοντικές απαιτήσεις της ζωής από τους πολίτες που δεν διαθέτουν γνώσεις και δεξιότητες που σχετίζονται με το STEAM. Ο μετασχηματισμός του ενδιαφέροντος για το STEAM σε συγκεκριμένη σχολική πρακτική πραγματοποιείται μέσω διαφόρων μέτρων, όπως η εισαγωγή STEAM θεματικών στα υπάρχοντα σχολικά προγράμματα και η επιμόρφωση των εκπαιδευτικών για την υλοποίηση εκπαιδευτικών δραστηριοτήτων STEAM.

Στο πλαίσιο αυτό το προκλητικό ζήτημα της εκπαίδευσης των μαθητών με Ήπιες Αναπηρίες αποκτά νέες σημαντικές διαστάσεις. Οι γνωστές μαθησιακές δυσκολίες αυτών των μαθητών καθιστούν αναγκαία την υιοθέτηση νέων διδακτικών λύσεων που θα διευκολύνουν την παραγωγική συμμετοχή τους σε δραστηριότητες STEAM. Διαφορετικά, η μαθησιακή απόσταση των μαθητών με Ήπιες Αναπηρίες από τους συμμαθητές τους χωρίς αναπηρία μπορεί να καταστεί μη διαχειρίσιμη. Από αυτή την άποψη, η συμβολή του έργου SpicE μπορεί να είναι σημαντική, καθώς ο κύριος στόχος του είναι να παρουσιάσει λειτουργικές λύσεις για την αποτελεσματική επιμόρφωση των εκπαιδευτικών στην συμπεριληπτική εκπαίδευση STEAM.

Προκειμένου να επιτευχθεί ο κύριος στόχος του έργου, οι συμμετέχοντες εταίροι πραγματοποίησαν μια συστηματική ανασκόπηση των πρακτικών STEAM και των συμπεριληπτικών εκπαιδευτικών πρακτικών που εφαρμόζονται στις χώρες τους αλλά και παγκοσμίως. Επιπλέον, διερεύνησαν τις γνώσεις των μελλοντικών και εν ενεργεία εκπαιδευτικών από τα εκπαιδευτικά τους συστήματα, όσον αφορά (α) την παρούσα κατάσταση της συμπερίληψης του STEAM σε κάθε χώρα και (β) τις εννοιολογήσεις σημαντικών διαστάσεων του STEAM στη συμπεριληπτική εκπαίδευση. Επιπλέον, διερευνήθηκαν οι προτιμήσεις και στάσεις των εκπαιδευτικών σε σχέση με την προοπτική συμμετοχής σε εξειδικευμένα εκπαιδευτικά προγράμματα που εστιάζουν σε αυτό το περίπλοκο ζήτημα. Τα κύρια αποτελέσματα αυτών των ερευνητικών προσπαθειών είναι τα ακόλουθα:

α) Όσον αφορά την εκπαίδευση STEAM:

- Οι διαφορετικές προοπτικές και η εστίαση σχετικά με την εκπαίδευση STEAM και την αξιοσημείωτη ποικιλομορφία ακόμη και σε βασικές έννοιες του τομέα καταγράφηκαν τόσο σε διεθνές όσο και σε εθνικά επίπεδα.
- Πολλοί μελετητές και επαγγελματίες του STEAM φάνηκαν να δυσκολεύονται με μια ολοκληρωμένη προσέγγιση των Τεχνών.
- Οι συνδέσεις μεταξύ του γραμματισμού περιεχομένου, της ανάγνωσης και της εκπαίδευσης STEAM, καθώς και η δημιουργία προγραμμάτων εκπαίδευσης STEAM που ενσωματώνουν τον γραμματισμό έχουν κερδίσει την προσοχή των ερευνητών, σε μια προσπάθεια να αρθούν τα όρια μεταξύ των παραδοσιακών ακαδημαϊκών μαθημάτων, όπως οι Φιλελεύθερες Τέχνες, και των κλάδων STEAM. Η εφαρμογή της εκπαίδευσης STEAM απαιτεί την κοινή προσπάθεια πολλών παραγόντων, συμπεριλαμβανομένων των υπευθύνων χάραξης πολιτικής, των κυβερνητικών αξιωματούχων, των διευθυντών σχολείων και των εκπαιδευτικών.
- Οι αντιλήψεις των εκπαιδευτικών για τα μαθήματα STEM φαίνεται να μην βρίσκονται σε αντιστοίχιση με την πολυετή διδακτική τους εμπειρία και να διαμεσολαβούνται από το ενδιαφέρον τους για τους κλάδους STEM.
- Η προθυμία των εκπαιδευτικών να εφαρμόσουν το πρόγραμμα σπουδών STEM βρέθηκε να επηρεάζεται άμεσα από τις πεποιθήσεις τους για την αυτο-αποτελεσματικότητα και την αξία που δίνουν στην εκπαίδευση STEAM.
- Η έλλειψη εργαλείων αξιολόγησης της ποιότητας, κατάλληλων προγραμμάτων σπουδών, διαχείρισης χρόνου και γνώσης των κλάδων STEAM φαίνεται να θεωρείται από πολλούς εκπαιδευτικούς, τόσο διεθνώς όσο και στις χώρες SpicE, ως σημαντικές προκλήσεις και εμπόδια στις πρωτοβουλίες STEAM.
- Η σημασία της κατάλληλης αρχικής και ενδοϋπηρεσιακής κατάρτισης των εκπαιδευτικών ως προϋπόθεσης για την αποτελεσματική εκπαίδευση STEAM ήταν ένα κοινό εύρημα της αντίστοιχης βιβλιογραφικής ανασκόπησης και έρευνας.
- Οι τέσσερις (4) χώρες του έργου SpicE βρέθηκαν σε μια φάση έντονων συζητήσεων, εξερευνήσεων και αλλαγών. Ωστόσο, οι μαθητές της πρωτοβάθμιας εκπαίδευσης με ήπιες αναπηρίες δεν έχουν συμπεριληφθεί συστηματικά στις προσπάθειες σχεδιασμού, οργάνωσης και υλοποίησης δραστηριοτήτων εκπαίδευσης STEAM.

β) Όσον αφορά την εκπαίδευση χωρίς αποκλεισμούς:

- Θεωρείται ευρέως αποδεκτό ότι η συμπεριληπτική εκπαίδευση πρέπει να παρέχει ένα μαθησιακό περιβάλλον χωρίς εμπόδια για όλους τους μαθητές, ανεξάρτητα από τις ατομικές τους διαφορές, και να μην περιορίζεται σε μαθητές με αναπηρίες. Ωστόσο, στην πράξη, οι περισσότερες χώρες εξακολουθούν να κατανοούν την εκπαίδευση χωρίς αποκλεισμούς κυρίως ως υποστήριξη για μαθητές με ειδικές εκπαιδευτικές ανάγκες και/ή αναπηρίες.
- Αναφορικά με τους ορισμούς, τις αξιολογήσεις, τα οργανωτικά ζητήματα και τις εκπαιδευτικές παραδόσεις που αναφέρονται στην ένταξη, η κατάσταση στις τέσσερις χώρες, αλλά και διεθνώς, χαρακτηρίζεται από μια αξιοσημείωτη ποικιλομορφία.
- Η μετατροπή της θεωρίας για τη συμπερίληψη σε συγκεκριμένη σχολική πρακτική είναι ένα πολύ δύσκολο έργο που μπορεί να διευκολυνθεί μέσω της χρήσης σαφών στόχων και συγκεκριμένων κριτηρίων αξιολόγησης σε κάθε περίπτωση προγράμματος συμπερίληψης που πραγματοποιείται σε ένα συγκεκριμένο πλαίσιο. Αυτό το γεγονός πραγματοποιείται αλλά δεν εφαρμόζεται στις περισσότερες χώρες, συμπεριλαμβανομένων των χωρών που συμμετέχουν στο έργο SpicE.
- Το εύρος υποστηρικτικών μέτρων που απαιτούνται για την εφαρμογή της επιτυχούς συμπερίληψης σε μια γενική τάξη μπορεί να είναι πολύ μεγάλο, λόγω των διαφορετικών αναγκών των μαθητών. Το γεγονός αυτό δημιουργεί απογοήτευση στους εκπαιδευτικούς.
- Παρά τις διαφορές τους σχετικά με την πρόοδο σε διάφορες παραμέτρους της Συμπερίληψης, και οι τέσσερις χώρες του έργου SpicE βρίσκονται σε μια φάση έντονων συζητήσεων, εξερευνήσεων και υλοποιήσεων. Κύριο στοιχείο αυτών των διαδικασιών είναι η αναγνώριση της ανάγκης για κατάλληλη επιμόρφωση των εκπαιδευτικών στις ιδιαιτερότητες της Συμπερίληψης.

γ) Όσον αφορά τις γνώσεις, τις στάσεις και τις επιμορφωτικές ανάγκες των εκπαιδευτικών πριν και κατά τη διάρκεια της εργασίας τους σχετικά με την συμπεριληπτική εκπαίδευση STEAM:

- Οι μελλοντικοί και εν ενεργεία εκπαιδευτικοί από τις τέσσερις συμμετέχουσες χώρες ανέφεραν σημαντικά μεγαλύτερη εξοικείωση με τις έννοιες και τις πρακτικές της εκπαίδευσης χωρίς αποκλεισμούς σε σύγκριση με την εκπαίδευση STEAM ή την εκπαίδευση STEAM χωρίς αποκλεισμούς.

- Το επίπεδο ικανοποίησης των εκπαιδευτικών από τα ήδη εφαρμοζόμενα προγράμματα STEAM ή Συμπεριληπτικής Εκπαίδευσης στις χώρες τους βρέθηκε μάλλον χαμηλό.
- Οι μελλοντικοί και εν ενεργεία εκπαιδευτικοί από τις τέσσερις χώρες έτειναν να έχουν κατανοήσει επαρκώς αρκετές βασικές θεωρητικές προϋποθέσεις της Συμπεριληπτικής Εκπαίδευσης STEAM, αν και παρουσίασαν επίσης κάποιες λανθασμένες αντιλήψεις, ειδικά σε σχέση με τη σημασία ορισμένων παραγόντων όπως ο ρόλος του προγράμματος σπουδών, η σημασία της εκπαιδευτικής αξιολόγησης και η ανάγκη θεωρητικής τεκμηρίωσης των εφαρμοζόμενων πρακτικών.
- Οι εκπαιδευτικοί ανέφεραν την έλλειψη επαρκών εκπαιδευτικών πόρων και τον αυξημένο φόρτο εργασίας ως σημαντικούς παράγοντες που εμποδίζουν την εφαρμογή της Συμπεριληπτικής Εκπαίδευσης STEAM.
- Η κατάλληλη επιμόρφωση των εκπαιδευτικών αναγνωρίστηκε ως ένας ισχυρός παράγοντας που θα μπορούσε να αντισταθμίσει ενδεχόμενες ανεπάρκειες άλλων εκπαιδευτικών παραγόντων.
- Οι μελλοντικοί και οι εν ενεργεία εκπαιδευτικοί εξέφρασαν το έντονο ενδιαφέρον τους να μάθουν για το STEAM, τη Συμπερίληψη και τον συνδυασμό των δύο τομέων.

Παρόλο που τα δείγματα από τις τέσσερις χώρες που συμμετείχαν στο SpicE ήταν διαφορετικά, οι γνώσεις, οι στάσεις και οι αντιλαμβανόμενες εκπαιδευτικές ανάγκες τους σε σχέση με τη συμπεριληπτική εκπαίδευση STEAM συγκλίνουν σε σημαντικό βαθμό. Αυτή η μετατροπή επέτρεψε την πραγματοποίηση μιας Ανάλυσης Κενών (επικυρωμένης από εκπροσώπους εκπαιδευτικών και Συλλόγους), η οποία απέδωσε χρήσιμες πληροφορίες για την υλοποίηση των επόμενων βημάτων του SpicE. Συγκεκριμένα, η Ανάλυση Κενών αποκάλυψε ότι η κατάρτιση των εν ενεργεία εκπαιδευτικών στη Συμπεριληπτική Εκπαίδευση STEAM θα πρέπει να θέσει ως προτεραιότητα τους μαθησιακούς στόχους ως εξής:

Στόχοι υψηλής σημαντικότητας: πρακτικές λύσεις για τη συμπερίληψη, STEAM στην καθημερινή σχολική πρακτική, ειδική μεθοδολογία για την εκπαίδευση STEAM χωρίς αποκλεισμούς, δυνατότητες της εκπαίδευσης STEAM στην προώθηση της συμπερίληψης, διασφάλιση της μαθησιακής προόδου των μαθητών, αξιολόγηση μαθητών με ήπιες αναπηρίες

Στόχοι μέσης σημαντικότητας: προσαρμογή προγράμματος σπουδών, STEAM σε ολοκληρωμένες τάξεις, θεωρητική κατάρτιση στην εκπαίδευση STEAM

Στόχοι χαμηλής σημαντικότητας: ειδίκευση σε τομείς STEAM, ενσωμάτωση μαθησιακών στόχων.

Στην περίπτωση των μελλοντικών εκπαιδευτικών, το πρόγραμμα εκπαίδευσης θα πρέπει να θέτει τους ακόλουθους στόχους:

Στόχοι υψηλής σημαντικότητας: πρακτικές λύσεις για τη συμπερίληψη, ειδική μεθοδολογία για την εκπαίδευση STEAM χωρίς αποκλεισμούς, θεωρητική κατάρτιση στην εκπαίδευση STEAM.

Στόχοι μέσης σημαντικότητας: δυνατότητες της εκπαίδευσης STEAM στην προώθηση της συμπερίληψης, διασφάλιση της μαθησιακής προόδου των μαθητών,

Στόχοι χαμηλής σημαντικότητας: STEAM στην καθημερινή σχολική πρακτική, προσαρμογή του προγράμματος σπουδών, STEAM σε ολοκληρωμένες τάξεις.

Προφανώς, οι προτεραιότητες για κάθε ομάδα διαφέρουν, αλλά στην ουσία οι εκπαιδευτικές τους ανάγκες είναι πολύ παρόμοιες, ειδικά λαμβάνοντας υπόψη το γεγονός ότι το εκπαιδευτικό πρόγραμμα θα είναι αρκετά ευρύ ούτως ώστε να ενσωματώνει πολλά διαφορετικά θέματα και δεξιότητες.

Executive summary (BG)

През последните години интересът на международната образователна общност към популяризирането на STEAM образованието се увеличи значително. Този интерес е резултат от убеждението, че STEAM - грамотните граждани могат да се справят по-добре с настоящите и бъдещите житейски изисквания, отколкото гражданите, които не притежават знания и умения, свързани със STEAM. Трансформирането на интереса към STEAM образованието в конкретна училищна практика се осъществява чрез различни мерки като въвеждане на STEAM дисциплини в съществуващите училищни програми и обучение на учители за прилагане на STEAM образователни дейности.

В този контекст предизвикателният въпрос за обучението на ученици с умерени обучителни затруднения придобива нови важни измерения. Добре известните обучителни трудности на тези ученици налагат приемането на нови решения за обучение, които ще улеснят тяхното продуктивно участие в STEAM образователни дейности. В противен случай дистанцията между обучение на ученици с обучителни затруднения и техните съученици без увреждания може да стане неуправляема. В това отношение приносът на проекта Spice може да бъде значителен, тъй като основният му фокус е да представи функционални решения за ефективно обучение на учители във приобщаващо STEAM образование.

За да постигнат основната цел на проекта, участващите партньори извършиха систематичен преглед на STEAM и практиките за приобщаващо образование, прилагани в техните страни, а също и по света. Освен това, бяха изследвани знанията на студентите по педагогика и на действащите педагози в рамките на техните образователни системи по отношение на (а) настоящата ситуация на приобщаващото STEAM образование във всяка страна и (б) концептуализациите на важни измерения на приобщаващото STEAM образование. Освен това бяха проучени предпочитанията на учителите по отношение на перспективата за участие в специализирани програми за обучение, фокусирани върху този сложен въпрос. Основните резултати от тези изследователски усилия са следните.

(а) Относно STEAM образование:

- Различни гледни точки и фокуси относно STEAM образованието и забележително разнообразие дори в ключови понятия в областта бяха отбелязани както на международно, така и на национално ниво.
- Много STEAM учени и практики изглежда се затруднява да посочат интегриран подход към изкуствата.
- Връзките между грамотността относно съдържание, четенето и STEAM образованието, както и създаването на вградени STEAM образователни програми за огромяване привлякоха вниманието на изследователите в опит да премахнат границите между традиционните академични предмети, като свободни изкуства и STEAM дисциплините.
- Внедряването на STEAM образование изисква съвместните усилия на множество заинтересовани страни, включително политици, държавни служители, училищна администрация и учители.
- Възприятията на учителите за дисциплините STEM изглежда имат противоречива връзка с годините им преподавателски опит и техния интерес към дисциплините STEM може да бъде проводник в тази област.
- Установено е, че желанието на учителите да прилагат учебната програма по STEM е пряко повлияно от техните убеждения за себе-ефективност и стойността, която придават на STEAM образование.
- Липсата на инструменти за оценяване на качеството, подходящи учебни програми, време за планиране и познаване на STEAM дисциплините изглежда се считат от много учители, както в международен план, така и в страните участници в SpicE, като важни предизвикателства и бариери пред STEAM инициативите.
- Значението на подходящото първоначално обучение и обучение на учители като предпоставка за ефективно STEAM образование е обща констатация от съответния преглед на литературата и изследвания.
- И четирите държави от проекта SpicE се оказаха във фаза на интензивни дискусии, проучвания и промени. Въпреки това, при работата с ученици с обучителни затруднения в начален етап, не са били включени систематично усилията за планиране, организиране и прилагане на STEAM образователни дейности.

(b) Относно приобщаващо образование:

- Широко разпространена е теорията, че приобщаващото образование трябва да осигурява учебна среда без бариери за всички учащи се, независимо от техните индивидуални различия, а не да се ограничава до ученици с увреждания. Въпреки това, на практика повечето страни продължават да разбират приобщаващото образование предимно като подкрепа за учащи със специални образователни потребности и/или увреждания.
- По отношение на дефиниции, оценки, организационни въпроси и образователни традиции, отнасящи се до приобщаването, ситуацията в четирите страни, а също и в международен план, се характеризира със отличаващо се разнообразие.
- Превръщането на теорията за приобщаване в конкретна училищна практика е много предизвикателна задача, която може да бъде улеснена чрез използването на ясни цели и конкретни критерии за оценка в случай към всяка програма, реализирана в конкретен контекст. Този факт се осъзнава, но не се прилага на практика в повечето страни, включително страните, участващи в проекта SpicE.
- Обхватът на подкрепата, необходима за осъществяване на успешно приобщаване в обща класна стая, може да бъде много широк, поради разнообразните потребности на учениците. Този факт създава разочарование сред учителите.
- Въпреки различията им по отношение на напредъка в различни параметри на приобщаване, и четирите държави от проекта SpicE са във фаза на интензивни дискусии, проучвания и внедрявания. Основен елемент от тези процеси е признаването на необходимостта от подходящо обучение на учителите в спецификата на приобщаването.

(с) Относно знанието, отношението и обучителните потребности на студенти по педагогика и педагогически специалисти, касаещи приобщаващо STEAM образование

- Преподавателите от четирите участващи страни съобщават за значително по-високо познаване на понятията и практиките на приобщаващото образование в сравнение със STEAM образование или Приобщаващо STEAM образование.
- Нивото на удовлетвореност на учителите от вече внедрените STEAM или програми за приобщаващо образование в техните страни е установено като доста ниско.
- Студентите и педагози от четирите държави са склонни да разбират добре няколко основни теоретични предпоставки на приобщаващото STEAM образование, въпреки че те също показаха някои погрешни разбирания, особено

по отношение на значимостта на определени фактори като ролята на учебната програма, значението на оценяването и необходимостта от теоретично документиране на прилаганите практики.

- Учителите посочиха липсата на достатъчно образователни ресурси и увеличеното натоварване като важни фактори, възпрепятстващи прилагането на приобщаващото STEAM образование.
- Подходящото обучение на педагозите беше признато за мощен агент, който може да компенсира евентуалната недостатъчност на други образователни фактори.
- Студенти и педагози изразяват силния си интерес да научат за STEAM, приобщаването и комбинацията от двете области.

Въпреки че извадките от четирите страни, участващи в SpicE, бяха разнообразни, техните знания, нагласи и възприемани потребности от обучение по отношение на приобщаващото STEAM образование се близки в значителна степен. Имено тази дискусия позволи реализирането на Gap анализ (валидиран от представители на учители и асоциации), който даде полезна информация за прилагане на следващите стъпки на SpicE. По-конкретно, анализът на пропуските разкри, че обучението на учители на работа в приобщаващото STEAM образование трябва да приоритизира учебните цели, както следва:

Цели с висока значимост: практически решения за приобщаване, STEAM в ежедневната училищна практика, специфична методология за приобщаващо STEAM образование, потенциал на STEAM образованието за насърчаване на приобщаването, осигуряване на напредъка в обучението на учениците, оценка на ученици с обучителни затруднения

Цели със средна значимост: адаптиране на учебната програма, STEAM в интегрирани класове, теоретично обучение по STEAM образованието

Цели с ниска значимост: специалност в STEAM области, интегриращи учебни цели.

В случай на студентите по педагогика, програмата за обучение трябва да постави следните цели:

Цели с висока практични решения за приобщаване, специфична методология за приобщаващо STEAM образование, теоретично обучение в STEAM образование

Цели със средна значимост: потенциал на STEAM образование за насърчаване на приобщаването, осигуряване на напредъка на обучението на учениците,

Цели с ниска значимост: STEAM в ежедневната училищна практика, адаптиране на учебната програма, STEAM в интегрираните класове.

Очевидно приоритетите за всяка група се различават, но по същество техните нужди от обучение са много сходни, особено предвид факта, че програмата за обучение ще бъде достатъчно широка, за да включва много различни предмети и умения.

Executive summary (SP)



En los últimos años ha aumentado considerablemente el interés de la comunidad educativa internacional por la promoción de la educación STEAM. Este interés se debe a la creencia de que los ciudadanos alfabetizados en STEAM pueden hacer frente mejor a las exigencias de la vida presente y futura que los ciudadanos que no poseen conocimientos y habilidades relacionados con STEAM. La transformación del interés por la educación STEAM en una práctica escolar concreta, se lleva a cabo a través de diversas medidas, como la introducción de disciplinas STEAM en los programas escolares existentes y la formación del profesorado en la aplicación de actividades de educación STEAM.

En este contexto, la difícil cuestión de la educación de los estudiantes con diversidad funcional leve adquiere nuevas dimensiones importantes. Las conocidas dificultades de aprendizaje de este alumnado exigen la adopción de nuevas soluciones pedagógicas que faciliten su participación productiva en las actividades de educación STEAM. De lo contrario, la distancia de aprendizaje del alumnado con diversidad funcional leve con respecto a sus compañeros y compañeras sin diversidad funcional puede llegar a ser inmanejable. En este sentido, la contribución del proyecto SpiceE puede ser significativa, ya que su principal objetivo es presentar soluciones funcionales para una formación eficaz del profesorado en educación STEAM Inclusiva.

Para alcanzar el objetivo principal del proyecto, los socios participantes llevaron a cabo una revisión sistemática de las prácticas STEAM y de educación inclusiva aplicadas en sus países y también en todo el mundo. Además, investigaron los conocimientos del profesorado en activo y en formación de sus sistemas educativos con respecto a (a) la situación actual de la Educación STEAM Inclusiva en cada país, y (b) las conceptualizaciones de importantes dimensiones de la Educación STEAM Inclusiva. Además, se exploraron las preferencias de actitud del profesorado en referencia a la perspectiva de participar en programas de formación especializados centrados en este complejo tema. Los principales resultados de estos esfuerzos de investigación fueron los siguientes

(a) Con respecto a la educación STEAM:

- Se registraron diferentes perspectivas y enfoques sobre la educación STEAM y una notable diversidad incluso en las nociones clave del campo, tanto a nivel internacional como nacional.
- Muchos estudiosos y profesionales de STEAM parecían luchar con un enfoque integrado de las artes.

- Las conexiones entre la alfabetización en contenidos, la lectura y la educación STEAM, así como la creación de programas de educación STEAM integrados en la alfabetización han atraído la atención de las y los investigadores, en un esfuerzo por eliminar las fronteras entre las materias académicas tradicionales, como las artes liberales, y las disciplinas STEAM.
- La implantación de la educación STEAM requiere el esfuerzo conjunto de numerosos agentes, como los responsables políticos, el funcionariado público, los administradores escolares y el profesorado.
- Las percepciones del profesorado sobre las asignaturas STEM parecían tener una relación inconsistente con sus años de experiencia docente y podrían estar mediadas por su interés en las disciplinas STEM.
- Se observó que la disposición del profesorado a aplicar el plan de estudios STEM se veía directamente afectada por sus creencias de autoeficacia y el valor que otorgan a la educación STEAM.
- La falta de herramientas de evaluación de calidad, planes de estudios adecuados, tiempo de planificación y conocimientos de las disciplinas STEAM parecen ser considerados por muchos profesores/as, tanto a nivel internacional como en los países SpiceE, como importantes retos y barreras para las iniciativas STEAM.
- La importancia de una adecuada formación inicial y continua del profesorado como requisito previo para una educación STEAM eficaz fue una conclusión común de la respectiva revisión bibliográfica e investigación.
- Los cuatro países del proyecto SpiceE se encontraban en una fase de intensos debates, exploraciones y cambios. Sin embargo, el alumnado de Primaria con diversidad funcional leve no habían sido incluidos sistemáticamente en los esfuerzos por planificar, organizar y poner en práctica actividades de educación STEAM.

(b) Con respecto a la educación inclusiva:

- Existe la teoría generalizada de que la educación inclusiva debe proporcionar un entorno de aprendizaje sin barreras para todos los alumnos, independientemente de sus diferencias individuales, y no limitarse al alumnado con diversidad funcional. Sin embargo, en la práctica, la mayoría de los países siguen entendiendo la educación inclusiva principalmente como un apoyo al alumnado con necesidades educativas especiales y/o diversidad funcional.

- En lo que respecta a las definiciones, las evaluaciones, las cuestiones organizativas y las tradiciones educativas relativas a la inclusión, la situación en los cuatro países, y también a escala internacional, se caracteriza por una notable diversidad.
- La conversión de la teoría sobre la inclusión en una práctica escolar concreta es una tarea muy difícil que puede facilitarse mediante el uso de objetivos claros y criterios de evaluación concretos en el caso de cada programa de inclusión realizado en un contexto específico. Este hecho es una realidad pero no se pone en práctica en la mayoría de los países, incluidos los países participantes en el proyecto SpiceE.
- La gama de apoyos necesarios para aplicar con éxito la inclusión en un aula general puede ser muy amplia, debido a las diversas necesidades del alumnado. Este hecho crea frustración entre el profesorado.
- A pesar de sus diferencias en cuanto al progreso en varios parámetros de la Inclusión, los cuatro países del proyecto SpiceE se encuentran en una fase de intensos debates, exploraciones e implementaciones. Un elemento principal de estos procesos es el reconocimiento de la necesidad de una formación adecuada del profesorado en los aspectos específicos de la Inclusión.

(c) Con respecto a los conocimientos, actitudes y necesidades de formación del profesorado en activo y en formación sobre la Educación STEAM Inclusiva

- El profesorado en activo y en formación de los cuatro países participantes declararon estar considerablemente más familiarizados con las nociones y las prácticas de la educación inclusiva que con la Educación STEAM o la Educación STEAM Inclusiva.
- El nivel de satisfacción del profesorado con los programas STEAM o de Educación Inclusiva ya implantados en sus países fue bastante bajo.
- El profesorado en activo y en formación de los cuatro países tendían a comprender bastante bien varias premisas teóricas básicas de la Educación Inclusiva STEAM, aunque también mostraban algunas falsas interpretaciones, especialmente en referencia a la importancia de ciertos factores como el papel del currículo, la importancia de la evaluación educativa y la necesidad de documentación teórica de las prácticas implementadas.
- El profesorado mencionó la falta de recursos educativos suficientes y el aumento de la carga de trabajo como factores importantes que obstaculizan la implantación de la Educación STEAM Inclusiva.

- Se reconoció que una formación adecuada del profesorado es un poderoso agente que podría compensar las eventuales insuficiencias de otros factores educativos.
- El profesorado en activo y en formación expresaron su gran interés por aprender sobre STEAM, la inclusión y la combinación de ambos campos.

Aunque las muestras de los cuatro países participantes en SpicE eran diversas, sus conocimientos, actitudes y necesidades de formación percibidas en referencia a la Educación STEAM Inclusiva convergen en un grado considerable. Esta convergencia permitió la realización de un análisis de brechas (validado por los representantes del profesorado y las asociaciones), que arrojó información útil para implementar los siguientes pasos de SpicE. En concreto, el análisis de brechas reveló que la formación del profesorado en activo en Educación STEAM Inclusiva debería priorizar los objetivos de aprendizaje de la siguiente manera:

Objetivos de gran importancia: Soluciones prácticas para la inclusión, STEAM en la práctica escolar diaria, metodología específica para la Educación STEAM Inclusiva, potencial de la Educación STEAM para promover la Inclusión, garantía del progreso en el aprendizaje y evaluación del alumnado con diversidad funcional leve.

Objetivos de importancia media: Adaptación curricular, STEAM en clases integradas, formación teórica en Educación STEAM

Objetivos de importancia baja: Especialidad en campos STEAM, integración de objetivos de aprendizaje.

En el caso del profesorado en formación, el programa de formación debería establecer los siguientes objetivos:

Objetivos de importancia alta: Soluciones prácticas para la inclusión, metodología específica para la Educación STEAM inclusiva, formación teórica en Educación STEAM.

Objetivos de importancia media: potencial de la Educación STEAM para promover la Inclusión, garantía del progreso en el aprendizaje del alumnado.

Objetivos de importancia baja: STEAM en la práctica escolar diaria, adaptación curricular, STEAM en clases integradas.

Obviamente, las prioridades de cada grupo difieren, pero en esencia sus necesidades de formación son muy similares, especialmente teniendo en cuenta el hecho de que el programa de formación será lo suficientemente amplio como para incorporar muchos temas y habilidades diferentes.

1. Introduction

STEAM Education is a contemporary interdisciplinary instructional approach that refers to teaching and learning in the fields of Science, Technology, Engineering, Arts, and Mathematics, and promises a positive impact on students' reasoning and critical thinking skills, creativity, and innovation. The integrated and connected curricula and the multi-faceted pedagogical practices through which STEAM Education is often implemented are considered favorable conditions for students to combine rigorous academic concepts with real-world situations, thus achieving valuable connections between school, community, work, and global societal problems (Peppler & Wohlwend, 2018; Quigley et al., 2017; Tsupros et al., 2009). In the course of building these connections students gradually acquire increased knowledge and skills in solving problems, making sense of information, knowing how to gather and evaluate evidence to make decisions, and generally adapting to an ever-changing and increasingly complex world. The acquisition of scientific knowledge and the development of skills in the aforementioned fields are considered key characteristics of STEAM literate citizens, who are regarded as better prepared for today's and future society than those lacking such cognitive assets (Dunn et al., 2012; Patton & Knochel, 2017).

STEAM Education gives teachers the opportunity to put to practice learning activities that cross each of the five disciplines and foster an inclusive learning environment in which all students, including those with disabilities, are able to engage and contribute. This opportunity may enhance the quality of daily life of students with disabilities, because STEAM knowledge and skills are fully embedded in everyday situations (e.g. operating electronic devices such as smartphones or iPads, using chemicals such as detergents and shampoos, calculating daily expenses). Moreover, individuals with disabilities who have advanced knowledge in STEAM fields are more likely to have greater work-related perspectives (Hwang & Taylor, 2016).

However, several barriers have been identified regarding the participation of students with disabilities in STEAM education activities. These barriers include, but are not limited to (a) student learning profiles characterized by restricted educational experiences and lack of prerequisite knowledge and skills, and (b) teacher instructional profiles characterized by insufficient knowledge and skills regarding how to include students with disabilities in STEAM education activities (Basham & Marino, 2010; Dunn et al., 2012). Evidently, students with type of disability may be affected by the above-mentioned barriers. However, special reference needs to be made to the population of students with Mild Disabilities, i.e. the population of students with Learning Disabilities, Mild Intellectual Disability, Attention Deficit / Hyperactivity

Disorder, and Mild Behavioral Problems. There is evidence that, if appropriately taught, these students may present considerable progress in the context of the general classroom (Ferguson, 2008). Probably then, they may also benefit from their participation in STEAM education activities implemented in this context. Nevertheless, students with Mild Disabilities are often excluded from such activities or they are left unaided to cope with their demands or they are asked to use the same means for accessing information as their peers who do not have learning difficulties (e.g., they are asked to deal with long and complex expository texts that reduce their chances of understanding scientific information). Wide-spread misconceptions regarding the nature of the difficulties of students with Mild Disabilities, as well as inadequacies in teacher initial and in-service training are two of the most important reasons explaining the restricted participation of students with Mild Disabilities in STEAM Education learning experiences (Hwang & Taylor, 2016; Moon et al., 2012).

In an effort to contribute to the improvement of the educational opportunities offered to students with Mild Disabilities in the context of Inclusive STEAM Education, the remainder of this report will delineate the international trends in STEAM Education and in Inclusive Education of students with Mild Disabilities, with a special emphasis on the situation prevailing in the countries participating in the SpiceE project. Specific foci of the report will be the attitudes exhibited toward and the knowledge possessed on Inclusive STEAM Education for students with Mild Disabilities by pre- and in-service teachers of the four participating countries. Evidence-based information on these issues is expected to contribute to building a sound basis for conducting a detailed needs analysis that will inform the next phases of SpiceE.

2. International trends in STEAM Education applications and the situation in the participating countries

In order to respond to the demands of the present era and the challenges of future life, citizens of modern societies need to possess abilities directly related to:

- problem – solving (using argument and evidence in order to frame, understand, and manage novel situations),
- innovation (having the mental power to pursue independent and original investigation),
- invention (recognizing the needs of life and designing creative solutions),
- technological literacy (understanding the nature of technology and mastering the

necessary skills)

➤ self-reliance (setting their own goals and work independently, while keeping at the same time functional connections to other persons)

(Avendano, et al., 2019; Dunn et al., 2012).

The educational community seeks constantly new instructional approaches in order to support students in their effort to become active citizens through the acquirement of the above-mentioned knowledge and skills. In this regard STEAM Education has been developed, as an extension of the initially framed STEM pedagogy (Videla et al., 2021). As already mentioned in the introduction of the present report, STEAM Education incorporates activities in the fields of Science, Technology, Engineering, Arts, and Mathematics. All these fields involve creative processes (e.g. comparing, sorting, counting, estimating, classifying, measuring, and graphing) and none uses just one method for inquiry and investigation. Thus, it is believed that instruction in these fields has the potential for preparing students to adapt to an ever-evolving world (Dejonckheere et al., 2016).

The increased worldwide interest in the implementation of STEAM Education programs is mirrored in the considerable number of publications focusing on this issue. Careful examination and systematic comparative study of these publications may produce interesting and influential conclusions regarding the contemporary trends in investigating and applying STEAM/STEM Education. Examples of such conclusions are the following:

- There are different perspectives and foci about STEAM education, and noteworthy diversity even in key notions of the field. For example, a considerable number of experts have not yet adopted the STEAM approach, but they rather continue to adhere to the STEM schema, supporting the view that the purposes of Art Education may be properly served by activities implemented in the context of the other disciplines (e.g. by designing a motor in Engineering Education students have opportunities for artistic expression and innovative presentation of their ideas). Furthermore, sizable parts of the scholarly and the practitioner community view STEAM Education as including instructional activities in the individual disciplines as well as interdisciplinary or transdisciplinary combinations of the individual STEAM disciplines. On the other hand, considerable parts of the same communities support the view that STEAM Education refers only to interdisciplinary or transdisciplinary combinations of the individual STEAM disciplines (English, 2016; Honey et al., 2014; Johnson et al., 2015; Kelley & Knowles, 2016). It is characteristic that, in their analysis of a total of 127 projects funded

by the Institute of Education Sciences (IES) of the US Department of Education from 2003 to 2019, Li et al (2020) found that the majority of the projects focused on individual STEM/STEAM disciplines, and especially on mathematics (88 projects). Of these 88 projects focusing on Mathematics, 54 projects had Mathematics as the only disciplinary focus (38 under “Education Research” program and 16 under “Special Education Research” program). There were also projects combining any two or more disciplines of STEM/STEAM Education (a total of 55 projects). The relatively limited number of projects on integrated STEM/STEAM Education has been interpreted as indication of the fact that the development of integrated programs presents considerable difficulties and is still in its initial stage (Honey et al., 2014; Li et al., 2020). Nonetheless, despite the diversity in the conceptualization and the implementation of STEAM Education there is noteworthy agreement regarding the expected benefits from the wide application of this educational approach (Kwan & Wong, 2021; Li, 2018a, b).

- Many STEAM scholars and practitioners struggle with an integrated approach to Arts, mainly because they lack: (a) the understanding about the variety of artistic expression, (b) the comprehension of the need to use measurable learning goals in trying to enhance creativity, problem-solving, and art expression in Arts Education, and (c) the criteria for determining the extent to which a scholarly investigation or an applied instructional activity referring to Arts should follow the multidisciplinary, interdisciplinary or transdisciplinary paradigm of STEAM Education. Consequently, Arts often take secondary priority to STEAM subjects, although there are also projects that put Arts in the center of their research and applications (Herro & Quigley, 2016; Vasquez et al., 2013; Williams, 2013).
- The connection among content literacy, reading and STEAM Education, as well as the creation of literacy-embedded STEAM Education programs have gained the attention of researchers in the last decade, in an effort to remove the boundaries between traditional academic subjects, such as Liberal Arts, and the STEAM disciplines. Removal of such boundaries is expected to allow the structure of integrated curricula with a wide instructional scope. Such curricula are regarded as appropriate for facilitating problem-based and project-based learning, which are favorable contexts for promoting student-centered instruction. However, these expectations need to be validated by field research in order to reach the status of evidence-based practices (Connor et al., 2015; Israel et al., 2013; Kennedy & Wexler, 2013).

- The number of students with disabilities participating in general classroom learning activities increases constantly worldwide. Inevitably, schools are constantly faced with the need to deal with the complex issue of the participation of students with disabilities in STEAM Education programs. There are some indications that participation of students with disabilities in STEAM Education activities may promote their scientific curiosity and function as a strong motive for sustained learning efforts (Burgstahler & Chang, 2014). However, STEAM Education activities constitute an under-researched area with insufficient information regarding the specialized instructional accommodations needed for overcoming obstacles created by the diverse learning features and the problems in knowledge acquisition that usually characterize students with disabilities (NSTC, 2021). Nonetheless, there is evidence that there are instructional tools, such as Universal Design for Learning (UDL), which may benefit many (if not all) students who want to be successful in STEAM Education, including students with disabilities (Basham & Marino, 2013).
- Implementation of STEAM Education requires the joint effort of numerous agents including policy-makers, government officials, and school administrators. Nevertheless, teachers are clearly the single most important factor in this complex endeavour (McMullin & Reeve, 2014). No matter how modern the curriculum and how well-equipped the school might be, it is the teacher who organizes the activities and makes use of the available resources. In the context of STEAM Education teachers have to provide specially designed lessons that encourage and enhance students' higher cognitive processes, while building also understanding of content and concepts. These are demanding instructional tasks presupposing teaching abilities not necessarily possessed by teachers who have been educated through traditional Programs of Studies and in-service training projects (Bruce-Davis et al., 2014; Nadelson & Seifert, 2013). However, despite the importance of teacher quality in the context of effective STEAM Education, the number of studies illuminating teachers' attitudes, beliefs, content-knowledge, and instructional skills with regard to STEAM Education is rather limited. Moreover, the results of such studies are often diverse or even contradictory. For example, Margot and Kettler (2019) conducted a systematic review of studies published between 2000 and 2017 and focusing on teacher perception of STEM integration and education (evidently these authors adhere to the STEM schema that preceded STEAM, but their study offers valuable insights into the

investigated subjects that apply also in the context of STEAM Education), and drew the following main conclusions:

- Teachers' perceptions of STEM subjects have inconsistent relationship to their years of teaching experience and may be mediated by their interest in STEM disciplines. Teachers' age, gender, and STEM experiences may affect their perceptions of STEM education.
- Cross-curricular STEM Education is generally perceived by teachers as beneficial to student learning, but there are also teachers, especially at the secondary education level, who mention several barriers or challenges to cross-curricular STEM programs.
- Teachers' willingness to implement STEM curriculum is directly affected by their self-efficacy beliefs and the value they place on STEM Education.
- A considerable number of teachers believe that the fundamental shifts in classroom organization that are considered necessary for implementing STEM Education are not always positive for all students.
- Lack of quality assessment tools, appropriate curricula, planning time, and knowledge of STEM disciplines are regarded by many teachers as important challenges and barriers to STEM initiatives, although the degree to which each factor is connected to problems in STEM application varies.
- School district support, guidance, and flexibility are regarded by teachers as necessary for successful STEM Education.
- Teachers strongly support the view that well-organized and frequent professional development opportunities facilitate effective STEM activities.
- The importance of appropriate initial and in-service teachers' training as a prerequisite for effective STEAM Education is accentuated by participants of various studies and is regarded as a rather common finding of the respective research (e.g. Margot & Kettler, 2019; Milner-Bolotin, 2017). Research-based information, evidence-based data as well as active teacher participation in well-organized training activities should be at the heart of teacher training in STEAM Education. Various training approaches have been proposed, which usually include modeling, reflecting, researching, and practicing activities related to STEAM Education (Herro & Quigley, 2017).

In their effort to keep up with the international developments and the increasing worldwide interest in the promotion of STEAM Education, most European countries take measures and

set priorities that may facilitate and enhance the implementation of STEAM Education in their school systems. Several EU-funded projects focusing on STEAM/STEM Education have been already implemented (such as STEAMonEdu, STE(A)M IT, CHOICE, EU STEM COALITION, ATS STEM, Learn STEM, and EuroSTEAM) and more projects (e.g. SpiceE, SEER) are in progress. Furthermore, European Schoolnet, a network of 34 European Ministries of Education embracing, apart from Ministries, key stakeholders such as schools, teachers, researchers, and industry partners, has declared STEM Education as one of its priorities (along with Digital Citizenship, Evidence for Innovation, New Teaching and Learning Models, and School Networking).

The countries participating in the SpiceE project follow the general European tendency regarding the promotion of STEAM Education. Some of their achievements in this respect appear in the next section of the present report.

2.1. STEAM Education in the countries participating in the SpiceE project

The internationally recognized need for promoting acquisition of STEAM skills through school programs has affected the educational policy and the scientific interest in the four countries of the SpiceE consortium. In what follows, the situation regarding efforts for the promotion of STEAM Education in each country is presented (countries in alphabetical order). Information comes from data provided by HOU, TU, UA, and UC, who were asked by the WP2 leader (UOM) to conduct a thorough investigation of publications and resources referring to STEAM Education in their country and compile a report on these issues. The information provided includes both measures taken by official educational authorities (State) and research initiatives of individual scientists specializing in STEAM/STEM Education.

(a) Bulgaria

The Ministry of Science and Education is the State Authority responsible for the infrastructure and the school conditions necessary for the implementation of STEM/STEAM Education in Bulgaria. In practical terms, most efforts are oriented toward the STEM schema, some focus on the STEAM approach, whereas references to STEAM Education for students with Mild Disabilities are extremely rare. Development of STEM pedagogy is supported through a specific National Program „Building a School STEM Environment“. However, political instability seems to hamper the full exploitation of the opportunities provided by this Program. Specialized publications on STEM/STEAM Education present different perspectives of the issue (STEM/STEAM as an educational approach, as a method, and as a curriculum).

Examples of good practices for the implementation of STEAM Education are available in the Bulgarian bibliography, which, however, is still at a level that can be characterized as informational (no references to wide or detailed applications).

According to the respective research, the percentage of in-service teachers who are familiar with the terminology and the main concepts of STEAM Education is rather low. Primary school teachers are those who are better informed regarding these issues. There is discussion on the importance of initial teacher training on STEAM Education, but much needs to be done yet in order for the situation to reach the desirable level.

(b) Cyprus

A growing interest in STEM education characterizes all educational levels supervised by the Ministry of Education, Sports and Youth (MoESY) in Cyprus. Although STEM education is not part of the primary education curriculum, nor part of teachers' compulsory professional development, MoESY promotes this contemporary pedagogy by implementing pilot programs. Such a program started in 2019. It was implemented in the afternoon school twice a week (for a total of four teaching periods), as an optional subject for 6th grade students who intended to attend it. Instructors were in-service teachers with postgraduate qualifications and/or experience in teaching subjects related to STEM. Overall evaluation of the program was positive, although it was recognised that some aspects of the course needed to be revised in order to fit the needs of the learners. In reference to the participation of students with disabilities in STEM activities there is lack of data that needs to be dealt with, in order for equal learning opportunities to be guaranteed for this part of school population.

During the last years' conferences, training days, and festivals focusing on STE(A)M Education are organized by the Educational Authorities, in collaboration with Universities and European Agencies. Thus, teachers have the opportunity to familiarize themselves with STE(A)M Education, although participation in the various informative activities is mostly optional.

(c) Greece

The interest of the Greek Ministry of Education and Religious Affairs in promoting STE(A)M Education was officially expressed and verified in 2021, when an educational innovation called "Skills Laboratories" was introduced in the curricula of certain grades of compulsory education. The activities of the Skills Laboratories are organized around four thematic axes. The 4th axis titled "Create and Innovate – Critical thinking and Initiative" includes "STEM/STEAM" as one

of its subjects (along with Educational Robotics, Entrepreneurship, New Technologies, and Familiarization with various Professions). Nevertheless, in the context of primary school (on which SpiceE focuses) STEM/STEAM is included only in the curriculum of the 1st, 4th, and 5th grades (out of the totally 6 grades of the Greek primary school). Moreover, the instructional time available for implementing STEM/STEAM related activities is clearly insufficient, since 1st graders have to work on subjects of the four thematic axes for just 3 hours per week, and 4th and 5th graders for 2 hours and 1 hour respectively. Considering the fact that the four axes of Skills Laboratories include more than 20 subjects in total, it is apparent that the instructional time that can be devoted to STEM/STEAM activities is very restricted. Furthermore, instructions on the implementation of STEM/STEAM lessons are fragmented and vague; hence, they can hardly guide daily school work.

The interest of the Greek Educational Authorities in promoting the interconnection of fields like Science, Art and Technology can be traced back to legislation passed in 2003. However, this early reference to interconnectivity of school subjects was part of the effort to support theoretically the introduction of the cross-curricular approach to learning and had hardly a connection to contemporary STEAM conceptualizations.

In terms of scientific interest of individual researchers or groups of scholars and practitioners in exploring and promoting STE(A)M Education, the situation in Greece is rather promising. The list of university departments, public or private schools, and other agents that have developed initiatives regarding STE(A)M Education or have participated in respective European Programs is not long, but it presents notable geographical dispersion which attests to the wide interest in STE(A)M approach exhibited by many educational stakeholders.

The few available data on the in-service teachers' attitudes toward STEAM Education, and the opinions these professionals hold about STEAM applications, reveal positive trends. The majority of in-service teachers who have participated in the restricted number of the respective studies seem to be familiar with the basic notions of the STEAM approach and to support its implementation. However, their practices in reference to STEAM have not been sufficiently investigated and are largely unclear. The situation regarding knowledge, attitudes and opinions of pre-service teachers in reference to STEAM is even more unclear, as exploration of this subject has started very recently.

(d) Spain

The strong interest of the Spanish Educational System in the promotion of STEAM Education is mirrored in the considerable number of STEAM applications put to practice in

recent years at various educational levels. A variety of educational means, equipment, and materials have been exploited during these applications, including educational robotics, smart and robotic platforms, and specialized ICT. Noteworthy numbers of (primary) students, including students with special educational needs, have participated in these STEAM-oriented programs, which followed the interdisciplinary approach and were implemented in the context of everyday school practice. Explorations of the attitudes, the opinions, and the achievements of the students who participated in the various STEAM Education applications showed positive stances and trends.

On the other hand, considerable percentages of teachers who were asked to teach in STEAM programs have expressed their concerns regarding their preparation in reference to the duties they had to deal with, although they acknowledged the benefits of STEAM approach and showed a positive attitude toward its use. These concerns resulted in discussions and explorations pertinent to the content and the orientation of pre-service teacher training. Results of this investigation process revealed that Mathematics and Experimental Science are included at a satisfactory degree in most Programs of Studies meant for prospective teachers, but it is imperative that courses directly related to contemporary STEAM conceptualizations are included in these Programs as compulsory subjects.

General conclusions

Evidently, the need for the promotion of STEAM Education is recognized in all four counties participating in SpiceE. Despite their differences regarding the progress in various parameters of the complex task to integrate STEAM-oriented activities in their educational systems, all four countries are at a phase of intense discussions, explorations, and changes. In all four counties it is obvious that some fields of the STEAM spectrum (notably Mathematics and Science) are at a more advanced level than the others, whereas Arts and Engineering are the subjects that have not found yet the place they deserve in the respective applications. An important common characteristic of STEAM Education in the four SpiceE countries is the fact that primary students with Mild Disabilities have not been included yet systematically in the efforts to plan, organize, and implement STEAM Education activities. As a matter of fact, information on this issue is dramatically restricted. This finding may be related to the general status of inclusive education of students with Mild Disabilities in the four counties, which is the focus of the next section of the present report.

3. International trends in Inclusive Education of Students with Mild Disabilities and the situation in the participating countries

Since its advent in the late '80s, inclusive education of students with disabilities, i.e. the instructional support of these students alongside their peers without disabilities in the general classroom, has gone through various stages characterized by intense discussions revolving around certain critical questions. For example, during the formation stage of educational inclusion as a new instructional paradigm for students with disabilities the main question was “where should students with disabilities receive education”. In recent years, however, the issue mostly discussed is rather “what concrete instructional measures should be taken in the general classroom, so that each student with disabilities presents progress in the subjects he/she is taught?”. This change in the main points of discussion about educational inclusion mirrors the alterations in philosophy, attitudes, practices, and applications that took place during the almost four decades of efforts to secure the active participation of students with disabilities in the instruction delivered in the general classroom (Kauffman, 2015). Nowadays, most of the ethical, social, legal, educational, and instructional arguments put forward by supporters of inclusion are largely accepted by wide circles of scholars and practitioners, who concentrate their efforts on the transformation of the educational inclusion theory into concrete practice. In this course, some conclusions resulting from many years of research conducted in several counties around the world may play important role and offer great help. Examples of such conclusions are the following:

- According to prevailing conceptualizations and in line with a rights-based approach to schooling, inclusive education should provide a barrier-free learning environment for all learners, regardless of their individual differences, and not be confined to students with disabilities. However, despite the growing recognition of this wider view, most countries still understand inclusive education primarily as support for learners with special educational needs (SEN) and/or disabilities in the context of general schools (European Agency, 2018).
- There are noteworthy differences across counties in definitions, assessments, organizational issues, and educational traditions referring to inclusive education of students with disabilities. These differences result in the existence of a range of policies that can be considered inclusive to various degrees. For example, some countries provide intense specialist support in the context of Inclusion, based on the view that general education settings do not have the capacity to support effectively learners with

disabilities. Such an approach, however, rather undermines the gist of Inclusion and may deprive students with disabilities from many valuable educational and social experiences (European Agency, 2022; UNESCO 2020).

- In spite of any difficulties in implementing inclusive education, the percentage of students (ages 6–21) who spent at least 80% of their time in general education classrooms grows steadily and considerably in most countries keeping reliable educational statistics (e.g. European Agency, 2022). Nonetheless, the real outcomes of most inclusive efforts remain vague and obscure. Too many students with disabilities may be in the general classroom without succeeding as learners, not so much because of their particular impairment or disability, but because of the incompatibility between the way they learn and the way instruction is delivered. Thus, influential agents such as UNESCO and the European Agency for Special Needs and Inclusive Education strongly support the need to base decision-making for the implementation of Inclusion not on “diagnoses” of disability but on careful assessment of the interaction between the student and the school environment. In this respect the role of the professionals who plan and put inclusion to practice is central and crucial (European Agency, 2018; UNESCO 2020).
- The type and the degree of students’ disability, as well as the attitudes, values and expertise of all the professionals involved in the implementation of inclusive education, are clearly important determinants of the learning progress exhibited by students with disabilities instructed in the general classroom (Meijer and Watkins, 2019). Research shows that students with Mild Disabilities, notably students with Learning Disabilities, are those most often supported through inclusive programs, whereas students with multiple disabilities and complex behavior problems are usually excluded from participating in general education activities (Ferguson, 2008).
- The range of the supports necessary for implementing successful Inclusion in a general classroom may be very wide, due to the diverse student needs. In looking for instructional means that may facilitate teaching in diverse classrooms, researchers have investigated the advantages of Universal Design for Learning (UDL), Differentiated Instruction (DI), and Information and Communication Technology (ICT). There is evidence that as means and tools for the application of valid and reliable (evidence-based) Instructional Methodology for the Inclusive Education of Students with Disabilities, UDL, DI, and ICT may offer valuable help, provided that the personnel

that uses them is sufficiently familiar with their nature and their demands (Florian & Spratt, 2013).

- Although theoretically much of what is considered necessary for transforming schools into inclusive systems is already known, there are still several challenges in this course, especially in terms of converting the respective theory to concrete practice. Contemporary schools experience an array of changes, not just those resulting from the need to become really inclusive. The coordination of the activities for making all these changes work is often a daunting task. Example of a complex endeavor emanating from the need for a new school identity is certainly the coordination of efforts for including students with Mild Disabilities in effective STEAM Education (European Agency, 2022; UNESCO 2020).

3.1. Inclusive education in the countries participating in the SpiceE project

The educational systems of Bulgaria, Cyprus, Greece, and Spain have been clearly affected by the strong international movement of inclusive education of students with disabilities. All four countries have undertaken measures facilitating Inclusion, in an effort to offer students with disabilities as many opportunities as possible for educational and social interactions with their peers without disabilities. In specific:

(a) Bulgaria

In the last two decades Bulgaria has undertaken decisive steps for putting an end to the status of residential care for children with disabilities that once prevailed in the country. Integration initiatives and even inclusive programs have been implemented on the basis of the Pre-school and School Education Act adopted in 2015. Recently passed laws on Social Services, People with Disabilities, and Family Benefits for Children further enhanced inclusive practices.

However, wide circles of the educational community believe that much remains to be done for creating a strong culture of inclusion at the school level. Involved authorities work systematically toward this end.

(b) Cyprus

In 2001 the Education and Training of Children with Special Needs 113(I) of 1999 was implemented favouring the integration of children with 'special needs' in mainstream education. Underpinning goal was that all children have the right to be educated together regardless of any disability. More specifically the law regulates the identification of children with 'special needs', their assessment and the development of an individualised educational program, their

placement (i.e. mainstream class, special school) with provision of both teachers and educational resources to meet their needs and on the ongoing evaluation of their progress.

Often students with disabilities may be supported through additional ‘special classes’ where they receive teaching support from special education teachers. These classes may take place two or three times a week, where they are expected to be taught literacy and maths skills. When children need further special educational support, they may attend special units within the school. These special units offer a varied educational program focusing on each child’s specific needs. Children attend special units for part of the day whereas for the rest of the day they join mainstream classes for school subjects which they can participate in and gain educational and social benefits through differentiated instruction.

Although University Programs of Studies for prospective teachers offer courses on Inclusion, the respective preparation for dealing with the demands of actual inclusive school practice is not considered sufficient. On the other hand, in-service teachers have many opportunities to attend seminars and other training activities that may help them combine their classroom experiences with contemporary research on Inclusion. However, participation in these activities is optional and based on personal interest. Differentiated instruction is encouraged in Cyprus and supported through the publication of appropriate guides by the Ministry of Education, but more emphasis needs to be placed on teacher knowledge and competences.

(c) Greece

The official introduction of inclusive education for students with disabilities in the Greek educational system took place in 2000 through the passing of a respective law. Since then systematic efforts are being recorded with regard to (a) the interest of Educational Authorities in promoting Inclusion through legislation and various seminars, and (b) the readiness of considerable numbers of researchers to investigate attitudes, aspects, and knowledge of school teachers pertaining inclusive education.

Most Greek studies on teacher opinions regarding Inclusion yield positive results. However, research going beyond trivial questions on the rights of students with disabilities, and what is educationally correct in theory, reveal a different situation. When teachers are asked to present their understanding of the details of inclusion implementation, as well as their knowledge on appropriate actions, roles, and responsibilities of the professionals involved in Inclusion, it becomes obvious that (a) general education teachers tend to regard inclusion as a situation that must be undertaken by “experts”, as they regard themselves as not properly trained to deal with the demands of this complex issue, and (b) special education teachers

usually lack crucial assessment, instructional, and organizational skills for transforming inclusion theory into concrete practice.

The above-described situation is directly connected to the fact that despite the rich rhetoric favoring Inclusion, very little has been done in terms of concrete field applications and interventions in real school circumstances. Hence, there are dramatically few paradigms of successful inclusionary programs that teachers could consider in organizing their own inclusionary efforts. In the few cases of real inclusionary applications the educational means of Educational Assessment, Rigorous Instruction, Cooperative Learning, and Continuous Program Evaluation have played a central role. However, in reference to the exploitation of the positive results emanating from these few studies, it should be noted that although legislation dictates the implementation of inclusionary programs, there are no state mechanisms and procedures examining school adherence to law provisions. Moreover, there is no systematic or mandatory connection between research on Inclusion and in-service teacher training.

In reference to pre-service primary teacher preparation for the inclusion of students with disabilities, it can be noticed that all the respective University Departments offer courses on Inclusion. Hence, all prospective teachers have the opportunity to acquire knowledge on Inclusion, but the extent to which this opportunity yields functional knowledge and skills in terms of field applications remains unclear.

Greek pre- and in-service teachers tend to state that in general terms and theoretically they are rather acquainted with important means for implementing inclusive education such as Differentiated Instruction, Universal Design for Learning, and Assistive Technology. However, practical use of these educational tools for putting to practice inclusionary programs is at a rudimentary level.

(c) Spain

Spanish state legislation of 2006 and 2020 has declared inclusive education and the personalization of learning as fundamental educational principles. However, the responsibility for specifying these general guidelines rests with the autonomous communities' governments. Regional authorities have adopted these general guidelines and put forward necessary efforts for implementing Inclusion in the context of their territorial and socio-cultural reality, with encouraging results.

Research on pre- and in-service teacher knowledge and attitudes regarding inclusion of students with (mild) disabilities is wide in Spain and for the most part reveals positive trends. In-service teachers, especially those with more years of teaching experience and some kind of specialized knowledge on the education of students with disabilities, tend to express positive

opinions regarding inclusive education. However, there are also studies showing the concern of Spanish teachers regarding the insufficient human and material resources, and also their need for more effective and continuous in-service training regarding Inclusion.

Pre-service teachers also express positive attitudes toward inclusive education. Research shows that prospective teachers who (a) tend to value their studies, (b) are in the last year of their studies, and (c) are female, tend to exhibit more positive attitudes.

Educational tools that may play important role in implementing Inclusion, like ICT, are well-known to Spanish teachers and used by them, although there are voices emphasizing the need for more resources and better teacher training on these issues.

General conclusions

According to the above-presented information, the need for the promotion of inclusive education of students with (Mild) Disabilities is accepted in all four counties participating in SpiceE. Despite their differences regarding the progress in various parameters of the complex task to include students with disabilities in the activities of the general classroom, all four countries are at a phase of intense discussions, explorations, and implementations. Main common findings of the research conducted in the four countries are (a) inclusive education is generally known to pre- and in-service teachers in theoretical terms, (b) implementation of inclusionary programs is considered as a goal requiring more efforts than those put to practice up to now, and (c) there is obvious need for teacher training in the specifics of the methodology of Inclusion and on the use of concrete means and tools that may facilitate this complex endeavour.

4. Using STEAM Education as a means for the promotion of Inclusive Education of Students with Mild Disabilities and the pivotal role of teachers

All four countries of the SpiceE project report that participation of (primary) students with (mild) disabilities in inclusive STEAM Education activities is practically non-existent in their schools. The situation is not very different in other countries. Nonetheless, there is some evidence coming from other educational environments that may offer valuable insights into this issue, although not all available data refers to primary students with mild disabilities and most of the existent research focuses on efforts in individual disciplines of STEAM and not on

interdisciplinary or transdisciplinary programs. For example, it has been found that when general education science teachers understood that complex concepts require time, scaffolds, and engaging experiences, and worked systematically to eliminate curriculum barriers through the use of graphic organizers, appropriate technology, and UDL, their students with Learning Disabilities were able to present remarkable learning progress in inclusive settings (Marino & Beecher, 2010).

In an effort to pinpoint important functional characteristics of US (secondary) schools implementing successful inclusive STEM programs, LaForce et al (2016) identified eight such elements: six of them (four instructional and two non-instructional) are regarded as core elements, and the other two are characterized as supporting elements. Instructional elements include: (a) *Personalization of learning* (learning customized for each student's unique ability and interests), (b) *Problem-based learning* (solving a problem [not strictly mathematical] to meet a learning goal), (c) *Rigorous learning* (instruction focusing on concrete content, and systematic processes that are challenging for students), (d) *Career, Technology, and Life Skills* (instruction and learning experiences focusing on knowledge and skills necessary to join the STEM workforce, and/or include skills, such as communication and time management, that will be useful in any future workplace). On the other hand, non-instructional elements refer to: (a) *School Community and Belonging* (instilling a strong school culture and providing students with support for emotional needs), and (b) *External Community* (schools' efforts and commitment to establishing and maintaining relationships with community members and institutions). The supporting elements identified by LaForce et al (2016) include: (a) *Staff Foundations* (intentional activities that enable instructional and non-instructional teachers' behaviors, which "set the stage" for student-directed components to take place), and (b) *Essential Factors* (contexts and conditions that school stakeholders identify as key to the successful implementation of STEM activities in their school, such as the external climate [political, cultural]).

All the aforementioned factors are clearly decisive determinants of successful inclusive STE(A)M programs not only at the secondary level, where the research of LaForce et al (2016) focused, but also at the primary level where the SpiceE project is aiming at. In addition to that, it is obvious that function and practical application of all eight factors are, at various degrees yet directly, affected by the attitudes, knowledge, and skills of the teachers implementing inclusive STE(A)M education. Hence, in order for the present consortium to put to practice a productive and effective pre- and in-service teacher training program in primary inclusive STEAM Education, attitudes, knowledge, and skills regarding all the individual components of

this complex endeavour have been examined in the four countries, and the results are presented in the next section of this report.

5. Pre- and In-service teacher knowledge on and attitudes toward Inclusive STEAM Education for students with Mild Disabilities in the participating countries

In order to gather the necessary data on pre- and in-service teachers' knowledge on and attitudes toward Inclusive STEAM Education for students with Mild Disabilities, SpiceE partners constructed a questionnaire that, apart from the demographics, included 30 questions. Content and foci of all questions were specified on the basis of findings coming from literature reviews of national and international resources.

In order to collect as specialized data as possible, the questionnaire included:

- 21 questions addressed to in-service teachers and focusing on important issues of STEAM and Inclusive Education applications,
- 2 questions addressed to pre-service teachers and exploring their opportunities to familiarize themselves with STEAM and Inclusive Education through the Programs of Studies of their Departments, and
- 7 questions addressed to both groups and investigating the level of their current knowledge and skills with regard to Inclusive STEAM Education, as well as their interest in acquiring specialized knowledge and skills about this complex issue through participation in training programs.

Elicitation of participants' answers was achieved through the use of various question types, such as Likert-type, open-ended, multiple choice, and dichotomous questions. Questions were preceded by references to customary ethical provisions and specifications, and also by a text explaining the scope of the study and the aims and goals of SpiceE. Furthermore, participants were asked to sign a declaration of consent to participation in the research.

The initial form of the questionnaire was constructed by the WP2 leader in English language, and was sent to all partners who offered their valuable feedback. Consequently, the final form of the questionnaire was produced, which was (a) translated to the native language of each of the four participating countries, (b) piloted, and (c) distributed to pre- and in-service teachers. The questionnaire appears in Annex 1. The main features of a collective picture

mirroring the most important findings that resulted from the analysis of the data gathered in each participating country are:

5.1 Pre-service teachers

5.1.1 Demographics

The total number of participants was 301 (Bulgaria, 26 – Cyprus, 73 – Greece, 22 – Spain, 180) with females clearly outnumbering males (percentages of females ranged from approximately 77% to approximately 87% for Cyprus, Greece, and Spain, which provided data on this issue). Most participants from Cyprus and Spain (over 95%) belonged to the age groups <20 and 21-25, whereas participants from these age groups made up about 36% of the Greek sample. All participants from Cyprus and Spain and most participants from Bulgaria studied in Departments of Education or Pedagogy, whereas the majority of the Greek sample studied in Departments of Special Education. Participants' distribution to semesters of study was considerably wide.

5.1.2 Questions addressed only to pre-service teachers

Pre-service teachers were asked whether *the Program of Studies of their Department included separate or integrated courses on STEAM Education*. The majority of the participants from Cyprus, Bulgaria, and Greece answered positively (about 78%, 58%, and 50% respectively), whereas the majority of the Spanish pre-service teachers said that they do not know the answer to this question (75%).

Pre-service teachers were also asked whether *the Program of Studies of their Department included separate or integrated courses on the Educational Inclusion of students with Mild Disabilities*. Affirmative answers were provided by the majority of Cypriot and Greek participants (approximately 97% and 86% respectively), whereas the majority of Bulgarian participants answered negatively (approximately 54%) and the majority of Spanish participants said that they do not know the answer to this question (approximately 53% - although a sizable group answered positively [about 43%]).

5.1.3 Questions addressed both to pre-service and in-service teachers

As already mentioned, the questionnaire included 7 questions that were addressed both to pre-service and in-service teachers. Five of these questions were ordinary Likert-type (7 level) questions, 1 was a Likert-type (7 level) question containing 11 separate items, that explored

participants' perceived training needs in reference to Inclusive STEAM Education, and 1 question was open-ended. Analysis of the answers to the first 6 questions yielded the results appearing in Tables 5.1. and 5.2.

Participants were asked to use a 7-point Likert scale (1 = extremely low level and 7 = extremely high level) in order to indicate

Table 5.1. Pre-service teachers' knowledge on and interest in STEAM and Inclusive Education

| | Mean (SD) | | | |
|---|-------------|-------------|-------------|------------|
| | Bulgaria | Cyprus | Greece | Spain |
| the level of their current knowledge on STEAM Education | 3.26 (1.69) | 3,86 (1.55) | 3,23 (1.71) | 2,5 (1.42) |
| the level of their personal interest in learning to implement STEAM Education programs in the general classroom | 5.69 (1.42) | 5,15 (1.55) | 6,05 (1.39) | 5,3 (1.58) |
| the level of their current knowledge on Inclusive Education of students with Mild Disabilities | 4.61 (1.73) | 5,38 (1.26) | 5,27 (1.66) | 4,2 (1.56) |
| the level of their personal interest in learning to implement Inclusive Education of students with Mild Disabilities | 5.69 (1.45) | 6,04 (1.14) | 6,55 (0.96) | 6,0 (1.31) |
| the level of their personal interest in learning how to use STEAM Education activities as means for the inclusion of students with Mild Disabilities in daily school practice | 5.43 (1.47) | 5,62 (1.37) | 6,32 (1.08) | 5,8 (1.34) |

Participants were asked to use a 7-point Likert scale (1 = extremely low level and 7 = extremely high level) in order to indicate their perceived needs with regard to courses on the following individual topics, which experts consider significant in the context of organizing successful inclusion of primary students with Mild Disabilities in STEAM activities of the general classroom

Table 5.2. Pre-service teachers' perceived needs regarding courses that may prepare them for the successful inclusion of primary students with Mild Disabilities in STEAM activities

| | Mean (SD) | | | |
|--|-------------|-------------|-------------|-------------|
| | Bulgaria | Cyprus | Greece | Spain |
| Instructional methodology for each of the STEAM fields | 6.04 (1.49) | 5.33 (1.31) | 6.05 (1.52) | 5.40 (1.53) |
| The theoretical background of STEAM Education | 5.57 (1.73) | 5.33 (1.30) | 5.59 (1.70) | 4.80 (1.58) |
| Practical solutions for the Educational Inclusion of students with Mild Disabilities | 6.00 (1.51) | 6.00 (1.06) | 6.55 (.80) | 6.00 (1.38) |
| Instructional methodology for students with Mild Disabilities | 6.04 (1.49) | 5.96 (1/20) | 6.14 (1.39) | 6.00 (1.35) |

| | | | | |
|--|-------------|-------------|-------------|-------------|
| Educational assessment of students with Mild Disabilities | 5.59 (1.65) | 5.82 (1.29) | 6.41 (1.09) | 5.80 (1.34) |
| Procedures for the ascertainment of all students' school progress | 6.00 (1.51) | 5.89 (1.24) | 6.18 (1.18) | 5.80 (1.34) |
| Ways for adapting the general school curriculum to the needs of students with Mild Disabilities | 5.91 (1.50) | 5.86 (1.39) | 6.23 (1.30) | 6.00 (1.35) |
| Ideas for incorporating STEAM Education in the daily school practice | 5.96 (1.57) | 5.79 (1.31) | 6.23 (1.27) | 5.80 (1.37) |
| Integrating multiple learning goals from different content areas | 5.78 (1.50) | 5.96 (1.04) | 6.09 (1.01) | 5.60 (1.42) |
| Organizing integrated STEAM lessons | 5.83 (1.51) | 5.74 (1.34) | 6.18 (1.18) | 5.70 (1.32) |
| Using STEAM Education as context for including students with Mild Disabilities in the learning activities of the general classroom | 6.13 (1.46) | 5.84 (1.28) | 6.36 (1.21) | 6.00 (1.33) |

At the end of the questionnaire participants had the opportunity to *mention any subject or issue not included in the 29 statements that preceded and could have an impact on the educational inclusion of students with Mild Disabilities in STEAM*.

Some of the most notable mentions were:

- The need for appropriately motivating teachers and students participating in inclusive STEAM programs.
- The need for properly adapting the facilities in which inclusive STEAM programs take place.
- The need for enhancing the socio-emotional dimension of teaching (values, respect, acceptance, empathy).
- The use of STEAM Education for increasing disability awareness.
- The importance of knowing how to include students with Mild Disabilities alongside students with other disabilities.
- The enhancement of Arts' presence in the context of inclusive STEAM programs.

5.1.4 Conclusions

The answers provided by the pre-service teachers from the four countries who filled in the questionnaire on inclusive STEAM Education of students with Mild Disabilities are not directly and fully comparable as there is diversity in certain features of the populations. On the other hand, there are also many common characteristics among the four groups that allow the formation of interesting tendencies and the drawing of noteworthy conclusions, which can

inform the organization of effective trainings on the use of STEAM activities for the Inclusion of students with disabilities. The most important of these conclusions are:

- STEAM Education and Inclusive Education of students with (mild) disabilities were in general terms and more or less known to pre-service teachers, as these subjects were included in the Program of Studies of the participants' Departments, although not in the same way, not necessarily as independent subjects, and not as compulsory courses. Participants' knowledge on the exact nature and the extent of the opportunities they have to learn about STEAM and Inclusive Education through the Program of Studies of their Departments varied.
- The level of current knowledge on STEAM Education was reported by participants from all four countries as being under the mean, at varying degrees, with participants from Cyprus reporting the highest level of knowledge among the four groups.
- The level of current knowledge on Inclusive Education of students with Mild Disabilities was reported by participants from all four countries as exceeding the mean, marginally in the cases of participants from Bulgaria and Spain and clearly in the cases of participants from Cyprus and Greece, with participants from Cyprus reporting the highest level of knowledge among the four groups.
- The degree of participants' personal interest in learning to deal with the demands of STEAM Education and the specifics of Inclusive Education was reported as being clearly over the mean for all countries, with Greek participants reporting the highest interest among the four groups in both cases.
- The degree of personal interest in learning to deal with the use of STEAM Education activities as means for the inclusion of students with Mild Disabilities in daily school practice was reported by participants from all four countries as clearly exceeding the mean, with Greek participants reporting the highest interest among the four groups.
- The interest in acquiring knowledge on Inclusive Education was higher than both the interest for STEAM Education alone and the interest for STEAM Education as means for the Inclusion of students with Mild Disabilities in three out of the four countries (participants from Bulgaria exhibited equal interest in Inclusive Education and STEAM Education as individual subjects).
- In reference to the eleven structural elements of effective training programs on Inclusive STEAM Education, that were derived from the respective literature, participants from all four countries reported that they perceive all of them as important,

as all their scores were clearly above the mean. The individual element that was considered as most important by all groups was *“Practical solutions for the Educational Inclusion of students with Mild Disabilities”*, whereas the element that received the lowest score was *“The theoretical background of STEAM Education”*.

- The answers of the pre-service teachers to the open-ended question could be characterized as hopeful and promising as they referred to some parameters that certainly deserve close inspection and may enrich the study of the complex issue of Inclusive STEAM Education for students with Mild Disabilities.

Although, as already mentioned, the populations of pre-service teachers who participated in the study were diverse, their answers have certainly merits and may be used for informing the decisions on their effective training in Inclusive STEAM Education for students with Mild Disabilities.

5.2 In Service teachers

5.2.1 Demographics

The total number of participants was 420 (Bulgaria, 160 – Cyprus, 130 – Greece, 68 – Spain, 62) with females clearly outnumbering males (percentages of females ranged from approximately 68% [Spain] to approximately 96% [Bulgaria]). Six individuals in total chose not to answer the question on gender.

In reference to participants' age, the majority of all four samples belonged to the combined age group 41-60 (41-50 and 51-60) (percentages ranged from approximately 52% [Greece] to approximately 76% [the other three countries], with the Cypriot and the Greek samples including also considerable participant numbers in the age group 31-40 [about 24% and 31% respectively]).

With regard to years of teaching experience in General Education the largest groups, though not the majority, for each sample were: the group with 1-10 years for Bulgaria, Greece, and Spain, and the group with 21-30 years for Cyprus. The Bulgarian and the Cypriot samples included also considerable numbers of participants with more than 31 years of teaching experience in General Education (27.5% and 18.2% respectively).

With regard to years of teaching experience in Special Education the largest groups, though not the majority, for each sample were: the group with 1-10 years for Bulgaria, Greece, and Spain, and the group with 11-20 years for Cyprus.

In terms of the degrees held by the participants, the majority of the Bulgarian, Cypriot, and Greek participants held Master's degrees, whereas the majority of the Spanish participants held Bachelor's Degrees. The Cypriot, Greek, and Spanish samples included also small (single digit) numbers of Ph.D. holders.

Regarding the possession of degrees of any level in any of the STEAM fields, positive answers gave few participants from each of the four countries (Bulgaria, 14.38% – Cyprus, 3.8% – Greece, 7.4% – Spain, 17.7%).

As far as the possession of degrees of any level in Special Education or Educational Inclusion of students with Disabilities is concerned, the reported numbers were higher than those reported for STEAM degrees in the case of Bulgaria, Cyprus, and Greece, whereas Spain reported lower number (Bulgaria, 20% – Cyprus, 29.2% – Greece, 39.7% – Spain, 12.9%).

5.2.2 Questions addressed only to in-service teachers and referring to their knowledge of STEAM or inclusive programs that were implemented in their educational system, and also their participation in such programs

a. Participant awareness of STEAM Education implementations in the educational system of their country?

| | Bulgaria | Cyprus | Greece | Spain |
|------|----------|--------|--------|-------|
| Yes% | 21.8 | 23.8 | 8.8 | 11.3 |

b. Participant knowledge of implementation details of the STEAM programs they knew that were implemented in their countries

Considerable, but varying across countries, parts of the participants who were aware of STEAM Education implementations in their country could not provide answers pertaining to the features of these programs. Inspection of the provided answers yields the following general findings:

-Program duration

Very diverse answers mentioning programs that lasted 1 hour and also programs that lasted up to 6 years.

-Grades of implementation

Very diverse answers mentioning programs that were implemented in Kindergarten and programs implemented in all grades of primary and secondary Education. Most reports mentioned programs for the 5th and 6th grade of primary school.

-Emphasis on individual STEAM domains or on all fields

The few answers on this question from Bulgaria, Cyprus, and Greece (Spain did not provide data) mentioned STEAM programs emphasizing all fields and also programs promoting especially the individual fields of Arts, Technologies, Science, Math (Bulgaria), Science, Computer Science, Arts – Technology - Environment, Technology (Cyprus), and Educational Robotics (Greece).

-Integrated lessons or lessons on individual domains

The majority of the participants who provided answers on this issue confirmed the existence of integrated lessons in the STEAM applications implemented in their country.

-Knowledge of the results of the STEAM Education programs

All four samples included sizable groups of participants declaring that the results of the STEAM programs they were reporting on were unknown to them (these groups were the majority of the Bulgarian and the Cypriot samples). Other groups of participants from all four samples answered that the programs were excellent or satisfying, while the Bulgarian, the Greek, and the Spanish samples included also answers declaring that the programs were below their expectations (for the Spanish sample this group was the largest).

c. Participant awareness of STEAM Education implementations in their school

| | Bulgaria | Cyprus | Greece | Spain |
|------|----------|--------|--------|-------|
| Yes% | 15 | 10.8 | 8.8 | 9.7 |

d. Participant knowledge of implementation details of the STEAM programs they knew that were implemented in their countries

A considerable part of the participants who were aware of STEAM Education implementations in their school could not provide answers pertaining to the features of these programs. Inspection of the provided answers yields the following general findings:

-Program duration

Very diverse answers mentioning programs that lasted 1 hour, programs that lasted up to 6 years, and also continuing programs the duration of which was decided by the teachers.

-Grades of implementation

Very diverse answers mentioning programs that were implemented in all grades of primary school, especially the two last ones.

-Emphasis on individual STEAM domains

The few answers on this question from Bulgaria, Cyprus, and Greece mentioned STEAM programs emphasizing the fields of Technologies, Science, Math, and Art in various

combinations (Bulgaria), Environmental Education, Design, Technology, Arts, and Robotics in various combinations (Cyprus), and Arts, Programming, Engineering, and Science (Greece).

-Integrated lessons or lessons on individual domains

The majority of the Bulgarian and the Cypriot participants confirmed the existence of integrated lessons in the STEAM applications implemented in their school, whereas the Greek participants said that there were not such lessons.

-Knowledge of the results of the STEAM Education programs

All four samples included groups of participants declaring that the results of the STEAM programs they were reporting on were unknown to them, and also groups of participants who said that the programs were excellent or satisfying, while the Bulgarian, the Greek, and the Spanish samples included also answers declaring that the programs were below their expectations.

e. Participant participation as trainees in STEAM Education programs (organized either by a central educational authority or by local agents)?

| | Bulgaria | Cyprus | Greece | Spain |
|------|----------|--------|--------|-------|
| Yes% | 21.8 | 8.5 | 16.2 | 8.1 |

f. Promotion of STEAM Education by the educational authorities supervising participants' schools through specific professional development activities?

| | Bulgaria | Cyprus | Greece | Spain |
|------|----------|--------|--------|-------|
| Yes% | 53.7 | 20.0 | 33.8 | 27.4 |

g. Participant participation as instructors in inclusionary programs for students with Mild Disabilities (organized either by a central educational authority or by local agents)?

| | Bulgaria | Cyprus | Greece | Spain |
|------|----------|--------|--------|-------|
| Yes% | 26.2 | 8.5 | 13.2 | 33.9 |

h. Promotion of Educational Inclusion of students with Mild Disabilities by the educational authorities supervising participants' schools through specific professional development activities

| | Bulgaria | Cyprus | Greece | Spain |
|------|----------|--------|--------|-------|
| Yes% | 58.7 | 50.0 | 48.5 | 61.3 |

i. A set of questions (Questions 16-22 of the questionnaire) focused on school parameters and instructional factors that may facilitate the implementation of STEAM programs. In specific, in-service teachers were asked to use a scale from 1 to 7, where 1 meant “strongly disagree” and 7 means “strongly agree”, in order to indicate their agreement with the statements appearing in Table 5.3.

Table 5.3. In-service teachers’ opinions regarding school parameters and instructional factors that affect implementation of STEAM programs

| | Mean (SD) | | | |
|---|-------------|-------------|-------------|-------------|
| | Bulgaria | Cyprus | Greece | Spain |
| In order to understand the content of STEAM fields, students should possess higher-order thinking skills. | 3.93 (1.39) | 3.93 (1.32) | 2.84 (1.51) | 3.6 (1.95) |
| Only teachers specialized in Science, Technology, Engineering, Arts, and Mathematics can undertake the responsibility of implementing STEAM Education in General Primary Schools. | 3.69 (1.88) | 3.46 (1.75) | 2.57 (1.58) | 3.2. (1.94) |
| Implementation of STEAM Education may be properly served by the Curricula currently used in Primary Schools provided that more STEAM-oriented learning activities are incorporated in the daily school routine. | 5.02 (1.62) | 4.72 (1.47) | 4.59 (1.55) | 4.7 (1.88) |
| Implementation of STEAM Education Programs in General Primary Schools is presently unattainable, due to the lack of sufficient educational resources. | 4.46 (1.76) | 4.54 (1.45) | 4.37 (1.78) | 4.7 (1.94) |
| Appropriate training of school teachers is such a powerful agent that it may compensate for eventual insufficiencies of other educational factors affecting the successful implementation of STEAM Education. | 5.69 (1.40) | 5.08 (1.35) | 5.09 (1.69) | 4.7 (1.96) |
| Effective implementation of STEAM Education Programs in General Primary Schools is not feasible, due to the increased workloads among teachers. | 4.27 (1.78) | 4.63 (1.53) | 4.07 (1.98) | 5.1 (2.02) |
| Integrated STEAM Education lessons are more beneficial to students than the teaching of each STEAM discipline separately. | 4.99 (1.24) | 4.79 (1.21) | 5.15 (1.58) | 4.9 (1.41) |

j. In-service teachers’ self-efficacy with regard to the instruction of students from the four categories of Mild Disabilities was also examined (Question 23 of the questionnaire) through a question asking them to state the confidence in their ability to teach students presenting one of the four types of Mild Disabilities.

Table 5.4. In-service teachers' self-efficacy regarding the instruction of students with Mild Disabilities

| | Mean (SD) | | | |
|------------------------------|-------------|-------------|-------------|------------|
| | Bulgaria | Cyprus | Greece | Spain |
| Specific Learning Disability | 3.76 (1.73) | 4.61 (1.98) | 4.81 (1.74) | 4,0 (2.12) |
| Mild Intellectual Disability | 4.41 (1.53) | 3.34 (2.01) | 4.40 (1.83) | 4,3 (2.16) |
| ADHD | 3.83 (1.71) | 4.41 (1.94) | 4.94 (1.70) | 4.3 (1.91) |
| Mild Behavior Problems | 4.29 (1.75) | 4.30 (1.98) | 5.32 (1.54) | 4,6 (1.94) |

k. The aspects of in-service teachers on the factors affecting the Inclusion of primary students with Mild Disabilities are evidently an important factor in the context of Inclusive STEAM Education for this student population (Question 24 of the questionnaire). These aspects appear in Table 5.5.

Table 5.5. In-service teachers' aspects on factors affecting Inclusion of primary students with Mild Disabilities

| | Mean (SD) | | | |
|---|-------------|-------------|-------------|------------|
| | Bulgaria | Cyprus | Greece | Spain |
| General education teachers' insufficient knowledge on Educational Assessment | 4.31 (1.63) | 4.77 (1.61) | 4.81 (1.55) | 5.3 (1.56) |
| High demands of General Curriculum | 5.15 (1.49) | 5.09 (1.63) | 4.74 (1.69) | 4.8 (1.74) |
| General education teachers' insufficient support by Special Education experts | 4.98 (1.62) | 5.25 (1.60) | 5.21 (1.70) | 5.9 (1.52) |
| Negative attitudes of students without disabilities toward the Inclusion of students with Mild Disabilities | 3.93 (1.56) | 3.52 (1.75) | 3.51 (1.61) | 4.5 (1.82) |
| General education teachers' insufficient knowledge on Instructional Methodology for students with Mild Disabilities | 4.92 (1.63) | 4.96 (1.73) | 5.40 (1.51) | 5.9 (1.30) |

l. The aspects of in-service teachers on the impact that STEAM Education may have in promoting the Inclusion of students with Mild Disabilities was the content of Question 25 of the questionnaire, and the results per country were:

| | Mean (SD) | | | |
|---|-------------|-------------|-------------|------------|
| | Bulgaria | Cyprus | Greece | Spain |
| STEAM Education may have a positive impact on the Educational Inclusion of students with Mild Disabilities. | 4.99 (1.37) | 5,60 (1,20) | 5,68 (1.36) | 5.6 (1.40) |

m. The aspects of in-service teachers regarding the impact of inclusive education on the learning progress of students without disabilities were explored through the Question 26 of the questionnaire, and the results per country were:

| | Mean (SD) | | | |
|--|-------------|-------------|-------------|-------------|
| | Bulgaria | Cyprus | Greece | Spain |
| Implementation of inclusionary programs for students with Mild Disabilities affects adversely the learning progress of students without disabilities | 3.91 (1.80) | 2.50 (1.53) | 1.84 (1.37) | 3.2. (2.12) |

n. The aspects of in-service teachers regarding the appropriateness of the general classroom as educational context for the instruction of students from the four categories of Mild Disabilities were investigated through the Question 27 of the questionnaire, and the results per country were those appearing in Table 5.6.

Table 5.6. In-service teachers' aspects on the appropriateness of the general classroom as educational context for the instruction of students with Mild Disabilities

| | Mean (SD) | | | |
|------------------------------|-------------|-------------|-------------|------------|
| | Bulgaria | Cyprus | Greece | Spain |
| Specific Learning Disability | 3.52 (1.58) | 3.88 (1.84) | 4,75 (1.84) | 4.6 (1.76) |
| Mild Intellectual Disability | 3.77 (1.50) | 3.00 (1.62) | 4,54 (1.92) | 4.8 (1.75) |
| ADHD | 3.65 (1.61) | 3.69 (1.81) | 4,84 (1.81) | 4.7 (1.72) |
| Mild Behavior Problems | 3.88 (1.49) | 3.73 (1.78) | 5,24 (1.65) | 5.0 (1.72) |

o. In-service teachers' opinion on the progress that may be exhibited by students with Mild Disabilities who would be appropriately taught in the general classroom was explored through Question 28 of the questionnaire and the result per country were:

| | Mean (SD) | | | |
|---|-------------|-------------|-------------|------------|
| | Bulgaria | Cyprus | Greece | Spain |
| If appropriately taught, students with Mild Disabilities may present satisfactory learning progress in the general classroom. | 4.92 (1.41) | 4.86 (1.36) | 5.97 (1.23) | 5.6 (1.49) |

5.2.3 Questions addressed both to pre-service and in-service teachers, and referring to knowledge and interest in learning about inclusive STEAM Education, as well as to perceived needs in terms of training

a. In-service teachers were asked to use a 7-point Likert scale (1 = extremely low level and 7 = extremely high level) in order to indicate their knowledge on and interest in Inclusive STEAM Education (Questions 11-15 of the questionnaire). [The same questions have been answered also by pre-service teachers]. The findings for the in-service teachers per country were those appearing in Table 5.7

Table 5.7. In-service teachers' knowledge on and interest in STEAM and Inclusive Education

| | Mean (SD) | | | |
|---|-------------|-------------|-------------|------------|
| | Bulgaria | Cyprus | Greece | Spain |
| Level of current knowledge on STEAM Education | 3.06 (1.58) | 2.09 (1.33) | 2.35 (1.44) | 2.5 (1.42) |
| Level of personal interest in learning to implement STEAM Education programs in the general classroom | 5.4 (1.46) | 4.70 (1.71) | 5.22 (1.64) | 5.3 (1.48) |
| Level of current knowledge on Inclusive Education of students with Mild Disabilities | 4.44 (1.53) | 3.65 (1.90) | 4.15 (1.89) | 4.2 (1.56) |
| Level of personal interest in learning to implement Inclusive Education of students with Mild Disabilities | 5.43 (1.54) | 5.34 (1.69) | 5.60 (1.46) | 6.0 (1.31) |
| Level of personal interest in learning how to use STEAM Education activities as means for the inclusion of students with Mild Disabilities in daily school practice | 5.27 (1.56) | 5.27 (1.57) | 5.41 (1.57) | 5.8 (1.34) |

b. The 29th question of the questionnaire asked in-service teachers to declare their perceived needs with regard to professional training on the following individual topics, which experts consider significant in the context of organizing successful inclusion of primary students with Mild Disabilities in STEAM activities. The same questions (with all the 11 items) was answered also by pre-service teachers.

Table 5.8. In-service teachers' perceived needs regarding professional development training that may help them implement successful inclusion of primary students with Mild Disabilities in STEAM activities

| | Mean (SD) | | | |
|---|-------------|-------------|-------------|------------|
| | Bulgaria | Cyprus | Greece | Spain |
| Instructional methodology for each of the STEAM fields | 5.48 (1.55) | 6.02 (1.13) | 5.75 (1.27) | 5.6 (1.49) |
| The theoretical background of STEAM Education | 5.25 (1.69) | 5.84 (1.31) | 5.31 (1.58) | 5.8 (1.38) |
| Practical solutions for the Educational Inclusion of students with Mild Disabilities | 5.83 (1.47) | 6.34 (1.01) | 6.24 (1.23) | 5.0 (1.79) |
| Instructional methodology for students with Mild Disabilities | 5.53 (1.59) | 6.10 (1.25) | 6.07 (1.25) | 5.9 (1.49) |
| Educational assessment of students with Mild Disabilities | 5.37 (1.60) | 5.95 (1.29) | 5.68 (1.35) | 5.8 (1.48) |
| Procedures for the ascertainment of all students' school progress | 5.38 (1.59) | 5.81 (1.36) | 5.63 (1.41) | 6.0 (1.21) |
| Ways for adapting the general school curriculum to the needs of students with Mild Disabilities | 5.49 (1.50) | 5.99 (1.10) | 6.12 (1.15) | 5.8 (1.48) |

| | | | | |
|--|-------------|-------------|-------------|------------|
| Ideas for incorporating STEAM Education in the daily school practice | 5.53 (1.57) | 6.24 (1.05) | 6.28 (1.07) | 5.5 (1.61) |
| Integrating multiple learning goals from different content areas | 5.57 (1.54) | 5.99 (1.10) | 5.84 (1.27) | 5.7 (1.58) |
| Organizing integrated STEAM lessons | 5.59 (1.55) | 6.09 (1.12) | 5.94 (1.23) | 5.5 (1.63) |
| Using STEAM Education as context for including students with Mild Disabilities in the learning activities of the general classroom | 5.48 (1.55) | 6.16 (1.10) | 6.18 (1.28) | 5.5 (1.65) |

c. The last question of the questionnaire (Question 30) gave participants' the opportunity to mention any subject or issue not included in the 29 statements that preceded and could have an impact on the educational inclusion of students with Mild Disabilities in STEAM activities.

Some of the most notable mentions were:

- The need for enhancing the presence of Arts in STEAM Education.
- The need for more spacious STEAM classrooms.
- The obligation to address separately the needs of the small schools.
- The enrichment of initial teacher education with STEAM courses.
- The employment of speech therapists, psychologists and other specialist for the support of teachers implementing STEAM for students with disabilities.
- Involvement of the family in STEAM Education programs.
- Reduction of the case load in primary school.
- Teacher access to free tools for the implementation of STEAM activities

5.2.4 Conclusions

As mentioned also in the case of pre-service teachers, the answers provided by the in-service teachers from the four countries who filled in the questionnaire on inclusive STEAM Education of students with Mild Disabilities are not directly and fully comparable as there was diversity in important features of the populations. On the other hand, there were also several common characteristics among the four groups that allowed the formation of notable general tendencies, which permitted the drawing of some useful conclusions. The most important of these tendencies and the respective conclusions, that could inform the organization of effective trainings for in-service teachers, were:

- There was considerable diversity regarding most of the demographic data of the four participant groups. As in the case of the pre-service teachers, females outnumbered males considerably. Sample differences that might have played a role in the answers provided include the differences in teaching experience in General and Special Education, and also the degrees held by the participants from each country. Of course, it could be hypothesized that the prospective participants of the training programs that will be developed by the SpiceE consortium may have similar differences with the four samples of the present research. Hence, the present findings could probably inform to a satisfactory degree the decisions pertaining to those programs.
- The number of the participants who were aware of the implementation of STEAM programs in the educational system of their country was low (for some countries considerably less than 10%). Moreover, participants' knowledge on the features of such programs was mostly fragmented and deficient. Although it cannot be decided whether the actual number of the implemented programs in each country was low or if it just happened that the participants were not properly informed on this issue, it can be hypothesized that the need for making STEAM Education known to wide educational circles in all four countries is high. Noteworthy is the finding that sizeable parts of the samples mentioned that the programs they were aware of did not meet the expectation of the educational authorities. Again the possibility should be considered that the participants did not possess all necessary information, but it should also be noted that the participants' percentages supporting this view are impressive enough to put this finding among those deserving closer inspection in the context of SpiceE applications. A similar situation with that described in reference to STEAM programs implemented at the level of the educational system of each participating country resulted from the participant answers with regard to STEAM applications at the level of their schools.
- Regarding the opportunities reported by the participants in terms of acquiring knowledge on STEAM Education through specialized training programs organized by educational authorities, the findings showed a situation that cannot be characterized as satisfactory. This finding shows also the need for the implementation of the SpiceE program.
- The general picture resulting from participants' reports in terms of inclusive education for students with Disabilities could be characterized as considerably better than the respective picture for STEAM Education. The numbers referred to by all four samples with regard to professional development activities organized by their countries'

educational authorities for supporting knowledge acquisition on Inclusion are clearly higher than the respective numbers referring to STEAM Education.

- In reference to school parameters and instructional factors that may facilitate the implementation of STEAM programs the findings that resulted from participants' answers showed:
 - Participants accepting the view that higher-order skills are required for students to understand the content of STEAM were in the minority of all four samples as all respective group scores were below the mean. A similar result was obtained regarding the notion that only teachers specialized in Science, Technology, Engineering, Arts, and Mathematics can undertake the responsibility of implementing STEAM Education in primary schools.
 - Regarding factors that might obstruct the implementation of STEAM Education the participants expressed opinions that seem to converge, as they agreed that the lack of sufficient educational resources and the increased workloads among teachers are important factors, although their scores in supporting these views were just a little above the mean.
 - Noteworthy and with significant repercussions for their training was the aspect of the participants that the existing Curricula may serve properly the implementation of STEAM Education provided that more STEAM-oriented learning activities would be incorporated in the daily school routine. To a certain extent this aspect contradicts with the view that integrated STEAM Education lessons are more beneficial to students than the teaching of each STEAM discipline separately, which was also supported by the majority of the participants (the scores for both these aspects were a little above the mean). The contradiction results from the fact that integrated lessons require a reform of the existing curricula, even a mild one, and not just their enrichment with STEAM-oriented activities.
 - Promising for the future of STEAM Education and for the aims of the SpiceE program is the finding that in participants' opinion appropriate training of school teachers is such a powerful agent that it may compensate for eventual insufficiencies of other educational factors. The scores of participants supporting this view were clearly above the mean.
- Regarding participants' self-efficacy in reference to the instruction of students from the four categories of Mild Disabilities the general picture is that their answers were around

the mean (most of them slightly higher than the mean, but also some of them below it). As comparatively more robust (higher means, smaller SDs) in this dimension appeared to be the Greek sample, which included the higher percent of participants with degrees of any level in Special Education or Educational Inclusion of students with Disabilities among the four samples. This is an optimistic finding showing that specialized training, like the training that will be implemented in the context of SpiceE, may bring about valuable results for students with Mild Disabilities.

- With regard to the factors affecting the Inclusion of primary students with Mild Disabilities the finding that all groups scored below the mean in reference to the effect of the negative attitudes of students without disabilities on Inclusion is a positive finding, as this factor has been mentioned in the past in many studies pertaining to inclusive education and has been used as an excuse for not implementing inclusionary programs. Closely connected to this finding and also positive may be characterized the finding that all groups' mean score regarding the possible adverse effect of inclusionary programs on the learning progress of students without disabilities is clearly below the mean. Undoubtedly, positive for the purposes of SpiceE are also the findings that participants recognized the importance of increased teacher knowledge on Educational Assessment and Instructional Methodology for students with Mild Disabilities as decisive factors of successful Inclusion. The role of the Curriculum, the importance of the collaboration between teachers and experts of Special Education, as well as the ability of students with Mild Disabilities to present learning progress in the general classroom if taught appropriately should be very welcome as they show that the thoughts of the majority of all four samples coincide with contemporary research in these issues.
- Like the pre-service teachers who participate in this research, the in-service participants acknowledged their restricted knowledge on STEAM (scores clearly below the mean for all groups) and Inclusive Education (scores just above the mean for three out of the four groups and below the mean for the fourth). They also showed their strong interest in learning about STEAM, Inclusion, and the combination of the two fields with scores clearly above the mean. If these findings constitute actual general tendencies and are valid also in the case of the teachers who are going to participate in the training that will take place in the context of SpiceE, then it can be said that there are favorable conditions for the success of this endeavour.

- In expressing their perceived needs with regard to professional training that would enable them to be successful in trying to include students with Mild Disabilities in STEAM activities in the general classroom, in-service teachers showed that they understand how wide this endeavour is and how many prerequisites it includes. The scores on the 11 parameters of instructional programs of inclusive STEAM Education are all clearly above the mean. Of course there are scores which deserve further deliberation or even deep analysis and scores that are in line with contemporary approaches to inclusive STEAM Education. The general picture, however, is favorable and optimistic in reference to the aims of the SpiceE project.

6. General conclusions and proposals

This Report offers valuable insights into the aspects, knowledge, opinions, and attitudes of general and special education pre- and in-service teachers from Bulgaria, Cyprus, Greece, and Spain in reference to STEAM Education, Educational Inclusion of Students with Disabilities, and the combination of the two fields for achieving Inclusive STEAM Education for primary students with Mild Disabilities. Despite the diversity of the samples, in general terms both pre- and in-service teachers showed that they possess reduced knowledge in all three fields, but have generally positive attitudes and high interest in learning how to be successful in Inclusive STEAM Education.

The gap analysis that follows will take into consideration all the above-mentioned information, theoretical elements and field results, and will be able to describe concrete profiles of the training programs that need to be implemented so that all aims of the SpiceE are achieved.

7. Gap analysis

This GAP analysis has taken into account all the above-mentioned information, theoretical elements and field results. This will help to describe concrete profiles of the training programs that need to be implemented in order to achieve the objectives. Specifically, the results have been structured on the basis of the following dimensions, which have emanated from all the above-mentioned information:

- ASPECTS RELATED TO THE SCHOOL SYSTEM
- TRAINING ISSUES
- IMPLEMENTATION ISSUES

7.1. Justification

As we know, the GAP analysis is a strategic analysis tool that provides a general framework for defining where we are today, as well as where we want to be and how we are going to get there.

GAP Analysis is the process of comparing the current situation with the desired future situation in order to create a series of actions that will help fill the identified gap.

The questions to be answered by the GAP analysis are therefore the following:

- Where are we now?
- Where would we like to be?
- Difference between the desired state and the current state
- [Projects and actions to be undertaken to close the gap¹]

The main benefit of a GAP analysis is that it forces you to think about the current situation, the desired future situation, the gap between the two and your action plan in a clear and structured way (view Fig. 1).

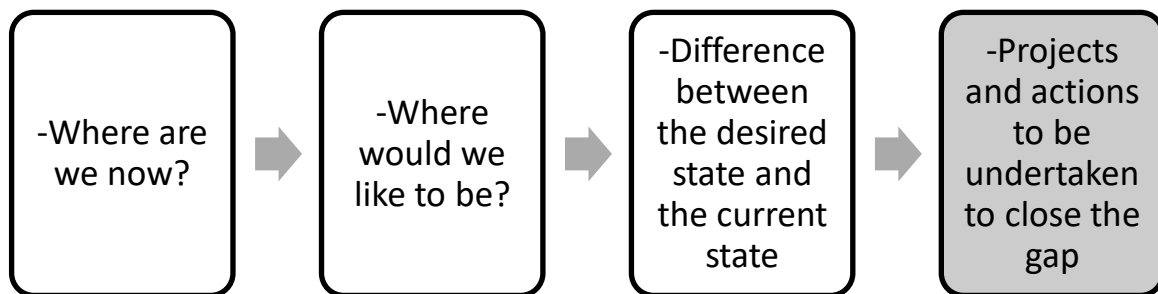


Fig. 1. Diagram GAP analysis.

7.2. Inclusion of students with Mild Disabilities in STEAM

According to the bibliography inclusion of students with Mild Disabilities in STEAM instructional activities presupposes that teachers:

| | |
|------------------|--|
| a. SCHOOL SYSTEM | <ul style="list-style-type: none"> • Are aware of the demands of inclusive education. • Possess abilities for implementing inclusive programs. • Know the specifics of STEAM education. |
|------------------|--|

¹ This part refers directly to the actions and activities that we will develop throughout the SpiceE project.

| | |
|---------------------|--|
| | <ul style="list-style-type: none"> • Are able to perform educational assessment of students with Mild Disabilities. • Are aware of the implementation of the STEAM program in the education system. • Are aware of the implementation of the STEAM program in the school where they work. • Possess specific training organised by the public administration for professional development on the implementation of STEAM in the classroom (Bogdan and Greca, 2018; López et al., 2021). • Possess specific training organised by the public administration for professional development on the inclusion of students with mild disabilities (Leiva-Olivencia et al., 2021). • Have specific initial training in STEAM education included in the curriculum of the Bachelor's Degree in Teaching in a multidisciplinary way (Castro-Rodríguez and Montoro, 2021). • Have specific initial training included in the curriculum of the Bachelor's Degree in Teaching for the inclusion of students with mild disabilities (Anzano, 2015; Arvelo-Rosales et al., 2021; Lacruz-Pérez et al., 2021; Sepúlveda et al., 2010). • Have availability of educational resources for the correct implementation of the STEAM program. • Have human and material educational resources for the proper implementation of educational inclusion (Chiner and Cardona, 2013; Fernández et al., 2020; Leiva-Olivencia et al., 2021). • Have the support of professionals with expertise in Special Education. |
| b. TRAINING ASPECTS | <ul style="list-style-type: none"> • Are aware of the characteristics of STEAM education. • Are aware of the characteristics of inclusive education for students with mild disabilities. • Have interest in learning how to implement the STEAM program in regular groups. • Have interest in learning how to implement the STEAM program using information and communication technologies (Jurado et al., 2020). • Have interest in learning how to apply inclusive education for students with mild disabilities. • Are able to make good use of information and communication technologies with students with mild disabilities (Cabero-Almenara et al., 2022; Fernández-Batanero et al., 2019, 2020, 2022). • Are interested in learning how to implement the STEAM program for the inclusion of students with mild disabilities. • Are aware that the STEAM program can be applied to all students, including those with mild disabilities. • Are aware that all teachers can implement the STEAM program, without the need to be specialised in Science, Technology, Engineering, Arts or Mathematics. • Are aware of the particularities of students with specific learning disabilities, mild intellectual disabilities, ADHD and mild behavioural problems in order to feel confident and able to meet their needs. |

| | |
|--------------------------------|--|
| | <ul style="list-style-type: none"> • Know how to carry out the assessment process for students with mild disabilities. • Are sensitised to educational inclusion, regardless of their years of teaching experience or whether or not they are special education teachers (Anzano, 2015; Campo et al., 2010; Cornoldi et al., 2018; Fiuza-Asorey et al., 2021; González-Gil et al., 2016; Mónico et al., 2020; Solís et al., 2019). • Are able to raise awareness of educational inclusion among non-disabled learners. • Know useful didactic methodologies for working with students with mild disabilities. • Know how to make use of STEAM-based digital educational activities in the classroom (Lara et al., 2020). • Know how to implement teaching methodologies for each STEAM area in the classroom. • Know the theoretical basis of STEAM education. • Are able to monitor the academic progress of all students. • Are capable of adapting the school curriculum to the needs of pupils with mild disabilities • Incorporate STEAM education into educational practice on a daily basis. • Integrate learning objectives from the different STEAM areas in the same didactic proposal. |
| c. IMPLEMENTATION ISSUES | <ul style="list-style-type: none"> • Are aware of the benefits that the STEAM program brings to the inclusion of students with mild disabilities. • Are aware of the improvement that STEAM education produces in children's attitudes towards science and in the development of numeracy, speaking and listening skills (Bogdan and Greca, 2018; Duo-Terron et al., 2022). • Know that the STEAM program promotes meaningful learning and student motivation (Lage-Gómez and Ros, 2021). • Use art as an area that integrates the rest of the STEAM fields in didactic proposals (Lage-Gómez and Ros, 2021). • Are aware of the benefits that educational inclusion programs for students with mild disabilities also bring to non-disabled students. • Are aware of the benefits for the learning of students with mild disabilities of being taught in the mainstream classroom. |

7.3 Knowledge and skills of pre- and in-service teachers

According to the report on the knowledge and skills of pre- and in-service teachers of the four participating countries:

PRE-SERVICE TEACHERS:

- They have limited knowledge on “Level of current knowledge on STEAM Education”, but they have more knowledge about Inclusive Education.

- Their perceived needs in terms of training are "practical solutions for the educational inclusion of students with mild disabilities".
- They believe that university training on STEAM and inclusive education exists, but there is a need to improve students' knowledge.
- They claim to have basic ideas about STEAM, Inclusive Education and Inclusive STEAM Education, but they say they have insufficient to acceptable knowledge.
- They have a strong interest in acquiring knowledge about STEAM, Inclusive Education and Inclusive STEAM Education.
- The level of personal interest in learning to implement Inclusive Education of students with Mild Disabilities is high in all the countries.
- They are interested and willing to be trained in STEAM and inclusive education.
- They consider that in order to implement the STEAM model for DE the following are necessary: training, motivation, resources and socio-emotional skills.

IN-SERVICE TEACHERS

- They have limited knowledge on the specifics of STEAM education.
- They have insufficient knowledge on STEAM education.
- The perceived needs in terms of training is the experience about STEAM and Mild Disabilities (MD).
- In reference to Inclusion they believe that is important to break down prejudices and myths.
- In reference to STEAM they believe that is important the willingness and training of teachers as a resource.
- They are aware of the demands of inclusive education.
- They are interested and willing to be trained in STEAM Education and/or Inclusive Education.
- They consider important the willingness and training of teachers as a resource for working in STEAM and MD.
- They think that the keys to strengthen interest in STEAM training and inclusive education are: motivation and values, as well as the socio-emotional part.
- They have more knowledge and experience about inclusive education and less about STEAM.
- They are aware of the demands of inclusive education

- They are interested and willing to be trained in STEAM Education and/or Inclusive Education.
- They think that the keys to strengthen interest in STEAM training and inclusive education are: motivation and values, as well as the socio-emotional part.
- They possess abilities for implementing inclusive programs.
- They are able to perform educational assessment of students with Mild Disabilities, etc.
- They see lack of resources and workload as barriers to the implementation of STEAM in MD.
- They are attracted to participate in new opportunities in the implementation of STEAM and inclusive education.
- They see the lack of support from education authorities in the implementation of STEAM Education as a factor of ineffectiveness.
- They consider that it is important to be trained in practical solutions for inclusive education, while the aspect that is of least interest is the theoretical background of STEAM education.

7.4 Training programs for pre- and in-service teacher

On the basis of the above it seems that training programs for pre- and in-service teachers need to concentrate on²:

IN-SERVICE TEACHERS

Listed below are a number of themes/activities on which actions for in-service and pre-service teachers can focus:

- ☐ **PRACTICAL SOLUTIONS FOR INCLUSION.** To know practical solutions for the educational inclusion of students with mild disabilities.
- ☐ **SPECIFIC METHODOLOGY.** Training in teaching methodologies for pupils with mild disabilities. On this point, in the survey, the active teaching staff in the different countries acknowledged that they lacked sufficient knowledge of teaching methodology for pupils with mild disabilities.

² The questionnaire used for the validation (one validation per country) can be accessed at <https://forms.gle/mp2zWDfn2NGEqPUz8>

- **STEAM IN DAILY SCHOOL PRACTICE.** To learn about ideas for incorporating STEAM education into everyday school practice.
- **THE POTENTIAL OF STEAM IN INCLUSION.** Acquire competences to know how to use STEAM education as a context for including students with mild disabilities in general classroom learning activities.
- **ADAPT THE SCHOOL CURRICULUM.** To know the ways of adapting the general school curriculum to the needs of pupils with mild disabilities.
- **STEAM INTEGRATED CLASSES.** To learn about methods of organising integrated STEAM classes.
- **THE SCHOOL PROGRESS OF PUPILS.** Learning procedures to determine the school progress of all pupils.
- **SPECIALITY STEAM FIELDS.** Training in teaching methodologies for each of the STEAM fields.
- **THEORETICAL TRAINING IN STEAM.** To know the theoretical background of STEAM education.
- **ASSESSMENT OF STUDENTS WITH MILD DISABILITIES.** To know methods of educational assessment of students with mild disabilities.
- **INTEGRATING LEARNING OBJECTIVES.** Integration of multiple learning objectives from different content areas.

PRE-SERVICE TEACHERS

- **PRACTICAL SOLUTIONS FOR INCLUSION.** To know practical solutions for the educational inclusion of students with mild disabilities.
- **THE POTENTIAL OF STEAM IN INCLUSION.** Acquire competences to know how to use STEAM education as a context for including students with mild disabilities in general classroom learning activities.
- **SPECIFIC METHODOLOGY.** Training in teaching methodologies for pupils with mild disabilities. On this point, in the survey, the active teaching staff in the different countries acknowledged that they lacked sufficient knowledge of teaching methodology for pupils with mild disabilities.
- **ADAPT THE SCHOOL CURRICULUM.** To know the ways of adapting the general school curriculum to the needs of pupils with mild disabilities.
- **THE SCHOOL PROGRESS OF PUPILS.** Learning procedures to determine the school progress of all pupils.

- **STEAM IN DAILY SCHOOL PRACTICE.** To learn about ideas for incorporating STEAM education into everyday school practice.
- **ASSESSMENT OF STUDENTS WITH MILD DISABILITIES.** To know methods of educational assessment of students with mild disabilities.
- **STEAM INTEGRATED CLASSES.** To learn about methods of organising integrated STEAM classes.
- **INTEGRATING LEARNING OBJECTIVES.** Integration of multiple learning objectives from different content areas.
- **SPECIALITY STEAM FIELDS.** Training in teaching methodologies for each of the STEAM fields.
- **THEORETICAL TRAINING IN STEAM.** To know the theoretical background of STEAM education.

These themes have been validated by SpiceE partners on the basis of their prioritization. The criteria used were: HIGH PRIORITY, PRIORITY and LESS PRIORITY. After the validation process carried out, the order of priority of the needs found for in-service teachers would be as follows:

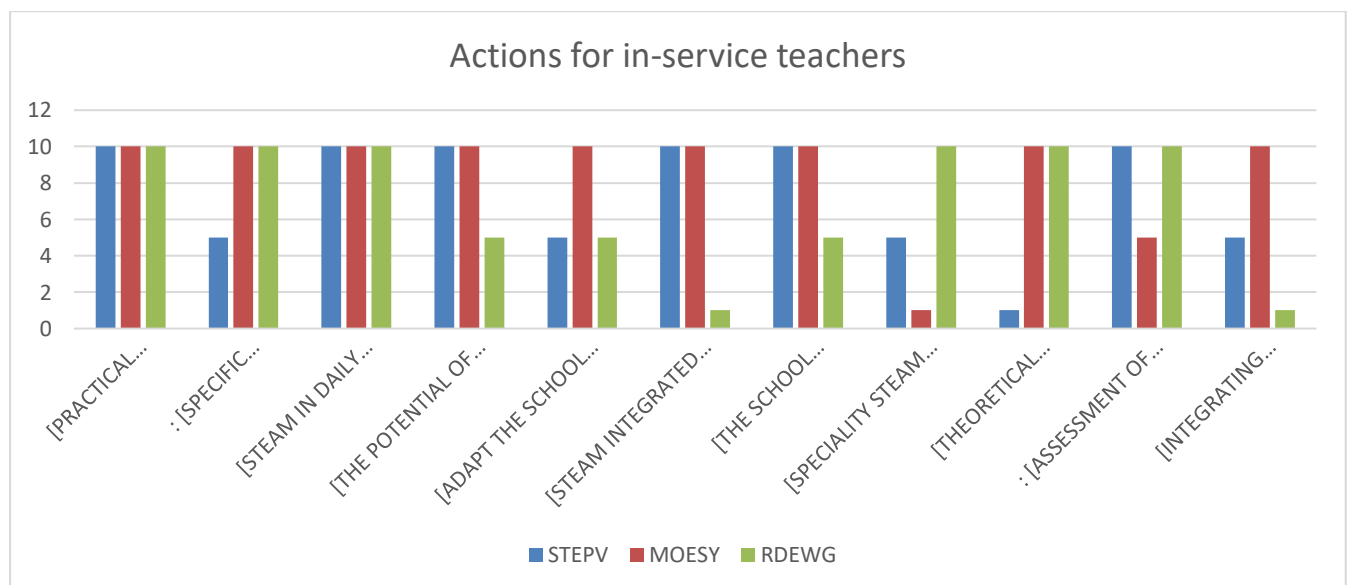


Chart 1: Results of actions for in-service teachers

To finally rank the actions according to their priority, the following criteria have been used:

HIGH PRIORITY: Actions with an average score above 8.

PRIORITY: Actions with an average score between 6 and 8.

LOW PRIORITY: Actions with an average score between 1 and 6.

The following table shows the results:

| ACTIONS FOR IN-SERVICE TEACHERS | | |
|---|---------------------------------|-----------------------------------|
| HIGH PRIORITY | PRIORITY | LESS PRIORITY |
| [PRACTICAL SOLUTIONS FOR INCLUSION] | [ADAPT THE SCHOOL CURRICULUM] | [SPECIALITY STEAM FIELDS] |
| [STEAM IN DAILY SCHOOL PRACTICE] | [STEAM INTEGRATED CLASSES] | [INTEGRATING LEARNING OBJECTIVES] |
| [SPECIFIC METHODOLOGY] | [THEORETICAL TRAINING IN STEAM] | |
| [THE POTENTIAL OF STEAM IN INCLUSION] | | |
| [THE SCHOOL PROGRESS OF PUPILS] | | |
| [ASSESSMENT OF STUDENTS WITH MILD DISABILITIES] | | |

As for the pre-service teachers, the same procedure has been followed as above and the same classification criteria have been used according to the average score obtained. Therefore, we can see below the chart of results and the table of priorities of the actions for pre-service teachers.

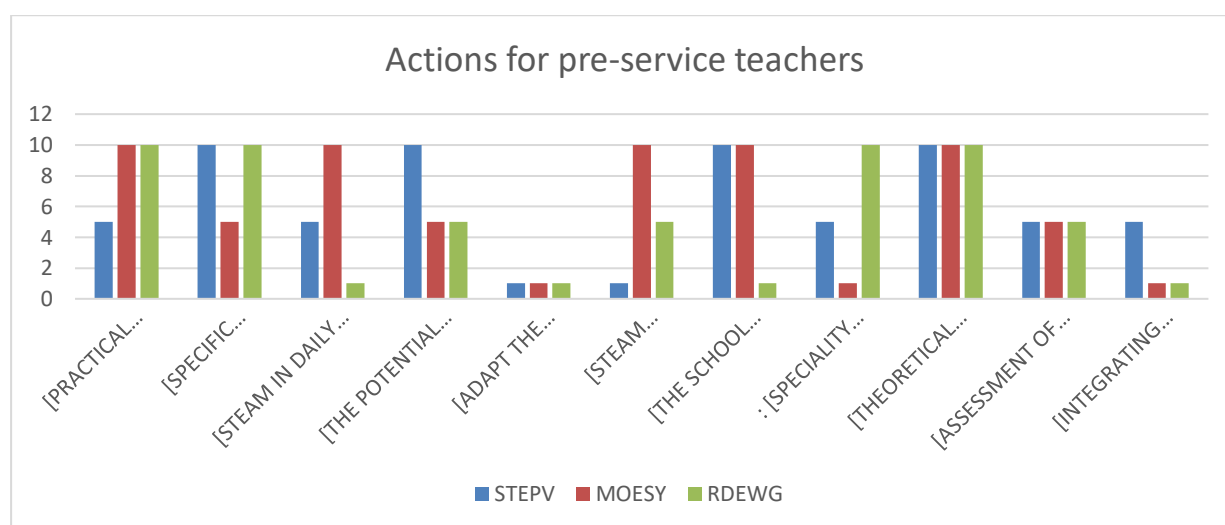


Chart 2: Results of actions for pre-service teachers

| ACTIONS FOR PRE-SERVICE TEACHERS | | |
|-------------------------------------|-------------------------------------|---|
| HIGH PRIORITY | PRIORITY | LESS PRIORITY |
| [PRACTICAL SOLUTIONS FOR INCLUSION] | THE POTENTIAL OF STEAM IN INCLUSION | [STEAM IN DAILY SCHOOL PRACTICE] |
| [SPECIFIC METHODOLOGY] | [THE SCHOOL PROGRESS OF PUPILS] | [ADAPT THE SCHOOL CURRICULUM] |
| [THEORETICAL TRAINING IN STEAM] | | [STEAM INTEGRATED CLASSES] |
| | | [SPECIALITY STEAM FIELDS] |
| | | [ASSESSMENT OF STUDENTS WITH MILD DISABILITIES] |
| | | [INTEGRATING LEARNING OBJECTIVES] |

The combination of the GA findings with the competence framework is expected to facilitate the decision making on the educational framework and ultimately to allow the implementation of a productive teacher training program on Inclusive STEAM Education.

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Internet resources

ATS STEM <https://www.atsstem.eu/>

CHOICE <https://www.euchoice.eu/>

EU STEM COALITION <https://www.stemcoalition.eu/>

European Schoolnet <http://www.eun.org/>

EuroSTEAM <https://tknika.eus/en/cont/proyectos/eurosteam-2/>

Learn STEM <http://learn-stem.org/>

SEER <https://www.seerproject.eu/>

STE(A)M IT <https://steamit.eun.org/>

STEAMonEdu <https://steamonedu.eu/platform/el/homepage>

ANNEX I QUESTIONNAIRE

Introductory Note

Dear participant,

STEAM Education is a contemporary instructional approach that lays emphasis on the teaching of **Science, Technology, Engineering, Arts, and Mathematics**. Instruction emphasizing STEAM-based activities is expected to enhance students' abilities in thinking scientifically, solving problems, using experimental learning, working creatively and generally in developing the qualities considered necessary for succeeding in the professional and social life of the 21st century.

Although all students can benefit from STEAM Education, the participation of students with **Mild Disabilities** (i.e. students with **Specific Learning Disability, Mild Intellectual Disability, Attention-Deficit/ Hyperactivity Disorder (ADHD), and Mild Behavior Problems**) in STEAM-based instruction is hampered by various factors. However, in the context of Educational Inclusion (learning in "One School for All"), students with Mild Disabilities should be properly supported in order to take part in all classroom activities.

In order to promote the research – based implementation of inclusionary STEAM educational programs for primary students with Mild Disabilities, our consortium (a group of Universities, State and Local Educational Authorities, Teacher Unions, and Private Agencies from Greece, Bulgaria, Cyprus, and Spain) has undertaken the responsibility to produce programs, materials and structures for (a) training teachers in the effective use of inclusionary STEAM Education for students with Mild Disabilities, and (b) providing them with ongoing access to related resources. This complex task presupposes the collection of data on the knowledge, the beliefs, and the needs of pre- and in- service teachers regarding the Inclusion of Primary Students with Mild Disabilities in STEAM Education learning activities. The present questionnaire serves the collection of such data.

You have been invited to participate in this research, because you are already a teacher in Primary Education or you are currently studying to become such a teacher.

To participate in the research, you will be asked to read carefully the following questions and statements and answer them to your best knowledge.

| |
|---|
| <p>1. ARE THERE ANY RISKS OR BURDENS REGARDING MY PARTICIPATION IN THE RESEARCH?</p> <p>Your participation in the research does not imply any risk or financial burden on you. However, we inform you that in the event of illegal acts or criminal activity your personal data is not protected from any investigation by the official authorities, and that we may have to take the necessary legal action in order to inform the authorities, especially if there is a risk to physical health or human life.</p> |
| <p>2. AM I OBLIGED TO PARTICIPATE IN THE RESEARCH?</p> <p>Your participation in the research is completely voluntary. You can refuse to participate without justification. You can change your mind at any time and leave the research without justification, and without consequences. In this case you can request the deletion of the collected data and information.</p> |
| <p>3. WILL I RECEIVE REMUNERATION?</p> <p>Participants will not receive remuneration for their participation in the survey.</p> |
| <p>4. HOW WILL MY PERSONAL DATA BE PROTECTED?</p> <p>We will collect the following personal data: gender, age, teaching experience, study semester etc. Your data will be used exclusively for research, scientific, and statistical purposes.</p> <p>Your data will be processed based on your explicit consent, which you provide to us through this form.</p> <p>Your data will be anonymized / pseudonymized / encrypted / encrypted [refer to the protection method / measures that you will apply].</p> <p>In no way will your identity be revealed in publications, public presentations or scientific reports. In case we want to use your data by name, we will ask you in advance for your explicit consent.</p> <p>In case of a group interview/ focus group, we encourage you to commit not to disclose information or details of other participants that came to your knowledge as part of the research.</p> <p>The Project keeps records of the research data for five (5) years from the completion of the research, following all the required organizational and technical security measures. The data will then be securely deleted/erased. If we consider that the research data is necessary to be used for other research or to be kept for archiving, scientific or historical research or statistical</p> |

purposes, we will proceed to their complete anonymization. Your rights regarding the protection of your personal data and their processing for the purpose of the present research are the following:

| | |
|--|--|
| Access | You can receive copies of your data being processed in the research context. |
| Correction | You can request corrections to your data being processed in the research context. |
| Portability | You can request that we transmit your data to another controller which is being processed in the research context. |
| Automated individual decision making | You can object to automated individual decision making including profiling. |
| You also have the right to withdraw your consent at any time. If this happens, you also have the following rights: | |
| Deletion | You can request that we delete your data being processed in the research context. |
| Restriction of processing | You can request a restriction of the processing of your data that have been processed in the research context. |
| Information | For more information you can contact: (to be added by each partner) |

DECLARATION OF CONSENT

I, the undersigned, declare that I have been fully informed of the terms of my participation in the research and the processing of my personal data.

I fully consent to participate in the research and to the processing of the above-mentioned personal data.

I have been informed that I can revoke my consent at any time.

Place:

Name of participant

Fullname:

Date:

Signature:

Personal data

A. FOR IN-SERVICE TEACHERS

Gender: Male ☐ Female ☐ I do not want to answer ☐

Age: 20-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐ 61-70 ☐

Years of teaching experience in General Education:

Years of teaching experience in Special Education:

Degrees:

- BA ☐
- MA ☐
- PhD ☐

Do you hold a degree (of any level) in any of the STEAM fields?

Yes ☐ No ☐

Do you hold a degree (of any level) in Special Education or Educational Inclusion of students with Disabilities?

Yes ☐ No ☐

1. Are you aware of concrete efforts to implement STEAM Education programs in the educational system of your country?

Yes ☐ No ☐

2. If the answer to the previous question was affirmative and you know details on the implementation of the STEAM program, then please answer the following questions:

-Duration of the program?.....

-Grades of implementation?

.....

-Was there an emphasis on one of the STEAM domains?.....

-On which one?.....

-Did the program offer integrated lessons?.....

-To the best of your knowledge, were the results

Excellent ☐ Satisfying ☐ Below expectations ☐ Unknown to you ☐ ?

3. Are you aware of concrete efforts to implement STEAM Education programs in your school?

☐ Yes

☐ No

4. If the answer to the previous question was affirmative and you know details on the implementation of the STEAM program, then please answer the following questions:

-Duration of the program?.....

-Grades of implementation?
.....

-Was there an emphasis on one of the STEAM domains?.....

-On which one?.....

-Did the program offer integrated lessons?.....

-To the best of your knowledge, were the results

Excellent ☐ Satisfying ☐ Below expectations ☐ Unknown to you ☐ ?

5. Have you ever participated as a trainee in a STEAM Education program (organized either by a central educational authority or by local agents)?

☐ Yes

☐ No

6. Is STEAM Education promoted by the educational authorities supervising your school through specific professional development activities?

☐ Yes

☐ No

7. Have you ever taught in an inclusionary program for students with Mild Disabilities (organized either by a central educational authority or by local agents)?

☐ Yes

☐ No

8. Is Educational Inclusion of students with Mild Disabilities promoted by the educational authorities supervising your school through specific professional development activities?

☐ Yes

☐ No

B. FOR PRE-SERVICE TEACHERS

Gender: Male ☐ Female ☐ I do not want to answer ☐

Age: <20 ☐ 21-25 ☐ 26-30 ☐ >30 ☐

Department/ Faculty:

Semester of studies:

9. Does the Program of Studies of your Department include separate or integrated courses on STEAM Education?

Yes ☐ No ☐ I do not know ☐

10. Does the Program of Studies of your Department include separate or integrated courses on the Educational Inclusion of students with Mild Disabilities?

Yes ☐ No ☐ I do not know ☐

THE FOLLOWING STATEMENTS 11 - 14 SHOULD BE ANSWERED BOTH BY PRE- AND IN- SERVICE TEACHERS

11. Using a scale from 1-7, where 1 means “extremely low level” and 7 means “extremely high level”, please indicate the level of your current knowledge on STEAM Education.

1 2 3 4 5 6 7

12. Using a scale from 1-7, where 1 means “extremely low level” and 7 means “extremely high level”, please indicate the level of your personal interest in learning to implement STEAM Education programs in the general classroom.

1 2 3 4 5 6 7

13. Using a scale from 1-7, where 1 means “extremely low level” and 7 means “extremely high level”, please indicate the level of your current knowledge on Inclusive Education of students with Mild Disabilities.

1 2 3 4 5 6 7

14. Using a scale from 1-7, where 1 means “extremely low level” and 7 means “extremely high level”, please indicate the level of your personal interest in learning to implement Inclusive Education of students with Mild Disabilities.

1 2 3 4 5 6 7

15. Using a scale from 1-7, where 1 means “extremely low level” and 7 means “extremely high level”, please indicate the level of your personal interest in learning

how to use STEAM Education activities as means for the inclusion of students with Mild Disabilities in daily school practice.

1 2 3 4 5 6 7
THE FOLLOWING STATEMENTS 16 - 28 SHOULD BE ANSWERED ONLY BY IN-SERVICE TEACHERS

Using a scale from 1 to 7, where 1 means “strongly disagree” and 7 means “strongly agree”, please indicate how much you agree or disagree with the following statements:

16. In order to understand the content of STEAM fields, students should possess higher-order thinking skills.

1 2 3 4 5 6 7

17. Only teachers specialized in Science, Technology, Engineering, Arts, and Mathematics can undertake the responsibility of implementing STEAM Education in General Primary Schools.

1 2 3 4 5 6 7

18. Implementation of STEAM Education may be properly served by the Curricula currently used in Primary Schools provided that more STEAM-oriented learning activities are incorporated in the daily school routine.

1 2 3 4 5 6 7

19. Implementation of STEAM Education Programs in General Primary Schools is presently unattainable, due to the lack of sufficient educational resources.

1 2 3 4 5 6 7

20. Appropriate training of school teachers is such a powerful agent that it may compensate for eventual insufficiencies of other educational factors affecting the successful implementation of STEAM Education.

1 2 3 4 5 6 7

21. Effective implementation of STEAM Education Programs in General Primary Schools is not feasible, due to the increased workloads among teachers.

1 2 3 4 5 6 7

22. Integrated STEAM Education lessons are more beneficial to students than the teaching of each STEAM discipline separately.

1 2 3 4 5 6 7

23. I feel confident to teach students with:

| | | | | | | | |
|-------------------------------|---|---|---|---|---|---|---|
| -Specific Learning Disability | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| -Mild Intellectual Disability | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| -ADHD | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| -Mild Behavior Problems | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

24. The following factors have a negative impact on the implementation of Inclusive Education of primary students with Mild Disabilities

| | | | | | | | |
|--|---|---|---|---|---|---|---|
| -General education teachers' insufficient knowledge on Educational Assessment | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| -High demands of General Curriculum | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| -General education teachers' insufficient support by Special Education experts | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Negative attitudes of students without disabilities toward the Inclusion of students with Mild Disabilities | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| -General education teachers' insufficient knowledge on Instructional Methodology for students with Mild Disabilities | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

25. STEAM Education may have a positive impact on the Educational Inclusion of students with Mild Disabilities.

1 2 3 4 5 6 7

26. Implementation of inclusionary programs for students with Mild Disabilities affects adversely the learning progress of students without disabilities.

1 2 3 4 5 6 7

27. Instruction in the general classroom is the appropriate educational context for students with:

| | | | | | | | |
|-------------------------------|---|---|---|---|---|---|---|
| -Specific Learning Disability | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| -Mild Intellectual Disability | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| -ADHD | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| -Mild Behavior Problems | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

28. If appropriately taught, students with Mild Disabilities may present satisfactory learning progress in the general classroom.

1 2 3 4 5 6 7

THE FOLLOWING STATEMENTS 29a – 29i SHOULD BE ANSWERED BOTH BY PRE- AND IN- SERVICE TEACHERS

Using a scale from 1 to 7, where 1 means “strongly disagree” and 7 means “strongly agree”, please indicate how much you agree or disagree with the following statements.

29. In order to be able to support the successful inclusion of primary students with Mild Disabilities in STEAM - based activities in the general classroom, I need to attend professional development activities (if you are an in-service teacher) or courses (if you are a pre-service teacher) focusing on:

29a-Instructional methodology for each of the STEAM fields

1 2 3 4 5 6 7

29b-The theoretical background of STEAM Education

1 2 3 4 5 6 7

29c-Practical solutions for the Educational Inclusion of students with Mild Disabilities

1 2 3 4 5 6 7

29d-Instructional methodology for students with Mild Disabilities

1 2 3 4 5 6 7

29e-Educational assessment of students with Mild Disabilities

1 2 3 4 5 6 7

29f-Procedures for the ascertainment of all students' school progress

1 2 3 4 5 6 7

29g-Ways for adapting the general school curriculum to the needs of students with Mild Disabilities

1 2 3 4 5 6 7

29h-Ideas for incorporating STEAM Education in the daily school practice

1 2 3 4 5 6 7

29i-Integrating multiple learning goals from different content areas

1 2 3 4 5 6 7

29k-Organizing integrated STEAM lessons

1 2 3 4 5 6 7

29l-Using STEAM Education as context for including students with Mild Disabilities in the learning activities of the general classroom

1 2 3 4 5 6 7

30. In the space provided below, please write any area or domain not included in the above statements that you consider important for the Educational Inclusion of primary students with Mild Disabilities in STEAM Education activities.

Thank you for your participation!

