SpicE

Special EduCation **STEAM Academy**

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WP2

Development of SpicE Strategy for STEAM in Special Education

DEV2.2 STEAM Educator Competence Framework and profile(s) for Special Needs

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Executive summary (EN)

Over the past few years, Inclusive Education and STEAM Education have emerged as highly influential educational approaches, garnering widespread attention and engagement from the global educational and scientific communities. This heightened attention has precipitated scholarly investigations pertaining to the fundamental definitions of each approach, aiming to establish clear conceptual frameworks. Additionally, studies have explored the specific needs and challenges faced by educators within the realms of Inclusive and STEAM Education. Moreover, efforts have been made to develop specialized training programs that equip educators with the necessary knowledge and skills to effectively employ Inclusive or STEAM Education methodologies.

Despite such amount of research regarding each approach separately, little evidence exists about their combination, with researchers' voices to underline the fact that the inclusion of students with disabilities in STEAM Education feels like a distant dream. In order for the latter to be further examined, partners from four different countries (Bulgaria, Cyprus, Greece and Spain), consisting the consortium of Erasmus+ project SpicE, have contributed to a) the description of the present situation of Inclusive STEAM education in their countries and b) the conceptualization of important Inclusive STEAM Education dimensions in previous project's Task 2.1 (GAP Analysis).

The current task involved integrating the findings from the literature review with the newly acquired insights. This amalgamation aimed to facilitate a comprehensive analysis of educators' needs and challenges in relation to Inclusive STEAM education. Through various methodological steps, including data analysis and synthesis, we have developed the Inclusive STEAM Educators' Competence Framework. Furthermore, in accordance with ESCO rules, we have formulated specific proposals for occupational profiles.

The Inclusive STEAM Educators' Competence Framework has been developed as an extension of the STEAM Educators' Competence Framework that had been developed in the Erasmus+ project STEAMonedu. It consists of five (5) perspectives,

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sixteen (16) competence areas, forty-two (42) competences and various competences' statements, describing in detail what educators' should be able to do in order to be successful in an Inclusive STEAM educational environment and what they should know and do in order to acquire every ability. The framework has been purposefully designed to serve two primary functions:

- ✓ as a self-assessment tool, enabling educators to evaluate their own proficiency and identify specific competences that require improvement. This self-assessment process empowers educators to enhance their effectiveness within the context of Inclusive STEAM primary education.
- ✓ as a guide and assessment tool for formulating and evaluating learning outcomes within targeted training programs. Specifically tailored to support and develop educators in the field of Inclusive STEAM primary education, the framework ensures that training programs align with the necessary competences and facilitate ongoing professional growth.

In addition to the Framework, the project has also developed four comprehensive occupational profile proposals crucial to the successful implementation of Inclusive STEAM education in primary schools. These occupational profile proposals were developed based on the initial proposals of occupation profiles from STEAMonedu Erasmus+ project. STEAMonedu served as a foundational resource and reference for the development of these profiles, providing valuable insights into the roles and responsibilities of educators within the context of STEAM education.

The four profiles encompass the following roles:

a) Inclusive STEAM primary school teacher: This profile delineates the specific responsibilities and duties of educators who integrate Inclusive STEAM practices within their primary classrooms.

b) STEAM special educational needs primary school teacher: This profile outlines the roles and responsibilities of educators specializing in supporting students with special educational needs in the context of Inclusive STEAM education.

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c) Inclusive STEAM learning support teacher: This profile provides detailed descriptions of the roles and responsibilities of learning support teachers in fostering Inclusive STEAM education, including their collaborative interactions with other educators.

d) Inclusive STEAM pedagogy expert: This profile focuses on individuals who possess specialized expertise in Inclusive STEAM pedagogy, highlighting their essential role in guiding and supporting educators in the implementation of effective instructional approaches.

These occupational profiles not only clarify the distinct responsibilities of each educator in an Inclusive STEAM primary classroom but also offer guidance on possible collaborative dynamics and instructional schemas. Furthermore, the profiles align with EQF (European Qualifications Framework level and propose new codes for inclusion in the ESCO (European Skills, Competences, Qualifications, and Occupations) taxonomy.

Finally, and concerning the new Inclusive STEAM Educators' Competence Framework, it will serve as the cornerstone of the project's next work packages, providing the essential guidance and structure needed to design effective training initiatives that enhance the competence and expertise of Inclusive STEAM Primary Educators.

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Executive summary (GR)

Τα τελευταία χρόνια, η Συμπεριληπτική Εκπαίδευση και η Εκπαίδευση STEAM έχουν αναδειχθεί ως εκπαιδευτικές προσεγγίσεις με μεγάλη επιρροή, συγκεντρώνοντας την ευρεία προσοχή και εμπλοκή της παγκόσμιας εκπαιδευτικής και επιστημονικής κοινότητας. Αυτή η αυξημένη προσοχή έχει προκαλέσει επιστημονικές έρευνες σχετικά με τους θεμελιώδεις ορισμούς κάθε προσέγγισης, με στόχο τη δημιουργία σαφών εννοιολογικών πλαισίων. Επιπροσθέτως, μελέτες έχουν διερευνήσει τις συγκεκριμένες ανάγκες και προκλήσεις που αντιμετωπίζουν οι εκπαιδευτικοί στο πλαίσιο της Συμπεριληπτικής Εκπαίδευσης και της Εκπαίδευσης STEAM. Επιπλέον, έχουν καταβληθεί προσπάθειες για την ανάπτυξη εξειδικευμένων προγραμμάτων κατάρτισης, που εφοδιάζουν τους εκπαιδευτικούς με τις απαραίτητες γνώσεις και δεξιότητες για την αποτελεσματική εφαρμογή των μεθοδολογιών της Συμπεριληπτικής Εκπαίδευσης ή της Εκπαίδευσης STEAM.

Παρά τον όγκο των ερευνών σχετικά με την κάθε προσέγγιση ξεχωριστά, υπάρχουν ελάχιστα στοιχεία ως προς τον συνδυασμό τους, με τις φωνές των ερευνητών να υπογραμμίζουν το ότι η συμπερίληψη των μαθητών με αναπηρία στην Εκπαίδευση STEAM φαντάζει μακρινό όνειρο. Προκειμένου το τελευταίο να εξεταστεί περαιτέρω, εταίροι από τέσσερις διαφορετικές χώρες (Βουλγαρία, Κύπρο, Ελλάδα και Ισπανία), που αποτελούν την κοινοπραξία του έργου Erasmus+ SpicE, συνέβαλαν α) στην περιγραφή της παρούσας κατάστασης της Συμπεριληπτικής εκπαίδευσης STEAM στις χώρες τους και β) στην αποσαφήνιση σημαντικών διαστάσεων της Συμπεριληπτικής Εκπαίδευσης STEAM, όπως αποτυπώνεται στην προηγούμενη Ενότητα 2.1 του έργου (GAP Analysis).

Η συγκεκριμένη Ενότητα συμπεριέλαβε την ενσωμάτωση των ευρημάτων της βιβλιογραφικής ανασκόπησης με τις νέες γνώσεις που αποκτήθηκαν. Αυτή η συγχώνευση είχε ως στόχο να διευκολύνει την ολοκληρωμένη ανάλυση των αναγκών

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και των προκλήσεων των εκπαιδευτικών σε σχέση με την Συμπεριληπτική Εκπαίδευση STEAM. Μέσω διαφόρων μεθοδολογικών βημάτων, συμπεριλαμβανομένης της ανάλυσης και της σύνθεσης των δεδομένων, αναπτύξαμε το Πλαίσιο Ικανοτήτων για εκπαιδευτικούς Εκπαιδευτικής Συμπερίληψης STEAM. Επιπλέον, σύμφωνα με τους κανόνες της ESCO, διαμορφώσαμε συγκεκριμένες προτάσεις για επαγγελματικά προφίλ.

Το Πλαίσιο Ικανοτήτων για εκπαιδευτικούς Συμπεριληπτικής Εκπαίδευσης STEAM αναπτύχθηκε ως επέκταση του Πλαισίου Ικανοτήτων για εκπαιδευτικούς STEAM που είχε αναπτυχθεί στο πλαίσιο του Erasmus+ έργου STEAMonedu. Αποτελείται από πέντε (5) προοπτικές- ρόλους, δεκαέξι (16) τομείς ικανοτήτων, σαράντα δύο (42) ικανότητες και διάφορα παραδείγματα ικανοτήτων, που περιγράφουν λεπτομερώς τι θα πρέπει να μπορούν να κάνουν οι εκπαιδευτικοί, για να είναι επιτυχημένοι σε ένα εκπαιδευτικό περιβάλλον Συμπεριληπτικής Εκπαίδευσης STEAM και τι θα πρέπει να γνωρίζουν και να κάνουν για να αποκτήσουν την κάθε ικανότητα. Το Πλαίσιο αυτό έχει σχεδιαστεί, ώστε να εξυπηρετεί δύο πρωταρχικές λειτουργίες:

- Ως εργαλείο αυτοαξιολόγησης, που θα επιτρέπει στους εκπαιδευτικούς να αξιολογούν τις δικές τους ικανότητες και να εντοπίζουν συγκεκριμένες ικανότητες που απαιτούν βελτίωση. Αυτή η διαδικασία αυτοαξιολόγησης ενδυναμώνει τους εκπαιδευτικούς στο να ενισχύσουν την αποτελεσματικότητά τους στο πλαίσιο της Συμπεριληπτικής Εκπαίδευσης STEAM στην Πρωτοβάθμια Εκπαίδευση.
- Ως οδηγός και εργαλείο αξιολόγησης για τη διαμόρφωση και αξιολόγηση των μαθησιακών αποτελεσμάτων στο πλαίσιο στοχευμένων προγραμμάτων κατάρτισης. Ειδικά προσαρμοσμένο για την υποστήριξη και την ανάπτυξη εκπαιδευτικών στον τομέα της Συμπεριληπτικής Εκπαίδευσης STEAM στην Πρωτοβάθμια Εκπαίδευση, το πλαίσιο διασφαλίζει ότι τα προγράμματα κατάρτισης ευθυγραμμίζονται με τις απαραίτητες ικανότητες και διευκολύνουν την συνεχή επαγγελματική εξέλιξη.

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Εκτός από το Πλαίσιο, το εν λόγω έργο ανέπτυξε επίσης τέσσερεις ολοκληρωμένες προτάσεις επαγγελματικού προφίλ, οι οποίες είναι ζωτικής σημασίας για την επιτυχή εφαρμογή της Συμπεριληπτικής Εκπαίδευσης STEAM στα δημοτικά σχολεία. Αυτές οι προτάσεις επαγγελματικών προφίλ αναπτύχθηκαν με βάση τις αρχικές σχετικές προτάσεις από το Erasmus+ έργο STEAMonedu. Το STEAMonedu λειτούργησε ως θεμελιώδης πηγή και σημείο αναφοράς για την ανάπτυξη αυτών των προφίλ, παρέχοντας πολύτιμες πληροφορίες σχετικά με τους ρόλους και τις ευθύνες των εκπαιδευτικών στο πλαίσιο της Εκπαίδευσης STEAM.

Τα τέσσερα προφίλ περιλαμβάνουν τους ακόλουθους ρόλους:

α) Δάσκαλος συμπεριληπτικής εκπαίδευσης STEAM: Αυτό το προφίλ περιγράφει τις συγκεκριμένες ευθύνες και τα καθήκοντα των εκπαιδευτικών, που ενσωματώνουν συμπεριλιπτικές πρακτικές STEAM στις τάξεις της πρωτοβάθμιας εκπαίδευσης.

β) Δάσκαλος ειδικής αγωγής STEAM: Αυτό το προφίλ περιγράφει τους ρόλους και τις αρμοδιότητες των εκπαιδευτικών, που εξειδικεύονται στην υποστήριξη μαθητών με ειδικές εκπαιδευτικές ανάγκες στο πλαίσιο της Συμπεριληπτικής Εκπαίδευσης STEAM.

γ) Εκπαιδευτικός συμπεριληπτικής μαθησιακής υποστήριξης STEAM: Αυτό το προφίλ παρέχει λεπτομερείς περιγραφές των ρόλων και των αρμοδιοτήτων των εκπαιδευτικών μαθησιακής υποστήριξης στην προώθηση της Συμπεριληπτικής εκπαίδευσης STEAM, συμπεριλαμβανομένων των συνεργατικών αλληλεπιδράσεών τους με άλλους εκπαιδευτικούς.

δ) Ειδικός συμπεριληπτικής παιδαγωγικής STEAM: Αυτό το προφίλ επικεντρώνεται σε άτομα που διαθέτουν εξειδικευμένη γνώση στην συμπεριληπτική παιδαγωγική STEAM, τονίζοντας τον ουσιαστικό τους ρόλο στην καθοδήγηση και υποστήριξη των εκπαιδευτικών στην εφαρμογή αποτελεσματικών διδακτικών προσεγγίσεων.

Αυτά τα επαγγελματικά προφίλ, όχι μόνο διευκρινίζουν τις διακριτές αρμοδιότητες κάθε εκπαιδευτικού σε μια συμπεριληπτική τάξη STEAM στην πρωτοβάθμια

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εκπαίδευση, αλλά και προσφέρουν καθοδήγηση σχετικά με δυναμικές συνεργασίας και διδακτικά σχήματα. Επιπλέον, τα προφίλ ευθυγραμμίζονται με το ΕΠΕΠ (Ευρωπαϊκό Πλαίσιο Επαγγελματικών Προσόντων) και προτείνουν νέους κώδικες για την συμπερίληψη στην ταξινόμηση της ESCO (Ευρωπαϊκή ταξινόμηση δεξιοτήτων, ικανοτήτων, προσόντων και επαγγελμάτων).

Τέλος, και όσον αφορά στο νέο Πλαίσιο Ικανοτήτων για εκπαιδευτικούς Συμπερίληπτικής Εκπαίδευσης STEAM, αυτό θα είναι ο ακρογωνιαίος λίθος των επόμενων πακέτων εργασίας του έργου, παρέχοντας την απαραίτητη καθοδήγηση και δομή που απαιτείται για τον σχεδιασμό αποτελεσματικών εκπαιδευτικών πρωτοβουλιών που ενισχύουν την ικανότητα και την εξειδίκευση των Εκπαιδευτικών Συμπεριληπτικής Εκπαίδευσης STEAM στην Πρωτοβάθμια Εκπαίδευση.

Executive summary (BG)

През последните няколко години приобщаващото образование и STEAM образованието се очертаха като подходи, които оказват силно въздействие в образованието и привличат широко внимание и ангажираност от глобалните образователни и научни общности. Това повишено внимание ускори научните изследвания, отнасящи се до фундаменталните дефиниции на всеки подход, целящи да установят ясни концептуални рамки. Освен това проучванията изследват специфичните нужди и предизвикателства, пред които са изправени преподавателите в сферата на приобщаващото и STEAM образованието. Нещо повече, положени са усилия за разработване на специализирани програми за обучение, които предоставят на преподавателите необходимите знания и умения за ефективно използване на приобщаващи или STEAM образователни методологии.

Въпреки толкова изследвания относно всеки подход поотделно, съществуват малко доказателства за тяхната комбинация, като изследователите подчертават факта, че включването на ученици с увреждания в STEAM образованието се чувства като далечна мечта. За да може последното да бъде допълнително проучено, партньори от четири различни държави (България,

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Кипър, Гърция и Испания), участващи в консорциум по проект SpicE, финансиран по програма „Еразъм +“, допринесоха за:

а) описанието на настоящата ситуация на приобщаващото STEAM образование в техните страни
б) концептуализацията на важни измерения на приобщаващото STEAM образование в предходната задача 2.1 (GAP анализ).

Текущата задача включваше интегриране на изводите от прегледа на литературата с новите проучвания. Това обединяване имаше за цел да улесни цялостния анализ на нуждите и предизвикателствата на преподавателите във връзка с приобщаващото STEAM образование. Чрез различни методологични стъпки, включително анализ и синтез на данни, ние разработихме Рамка за компетентностите на преподавателите в STEAM образованието. Освен това, в съответствие с правилата на ESCO, ние сме формулирали конкретни предложения за професионални профили.

Рамка за компетентностите на преподавателите в STEAM образованието е разработена като разширение на рамката на компетентностите на STEAM преподавателите, която беше разработена в проекта STEAMonedu по Еразъм+. Състои се от пет (5) гледни точки, шестнадесет (16) области на компетентност, четиридесет и две (42) компетентности и описания за различни компетентности, описващи подробно какво трябва да могат да правят преподавателите, за да бъдат успешни в приобщаващото STEAM образование и какво трябва да знаят и правят, за да придобият всяка способност. Рамката е целенасочено проектирана да обслужва две основни функции:

- ✓ като инструмент за самооценка, позволяващ на преподавателите да оценят собствените си умения и да идентифицират специфични компетентности, които изискват подобрение. Този процес на самооценка дава възможност на преподавателите да подобрят своята ефективност в контекста на приобщаващото начално STEAM образование.

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- ✓ като ръководство и инструмент за оценка за формулиране и оценяване на резултатите от обучението в рамките на целеви програми за обучение. Специално пригодена за подкрепа и развитие на преподаватели в областта на приобщаващото начално STEAM образование, рамката гарантира, че програмите за обучение са в съответствие с необходимите компетентности и улесняват непрекъснатото професионално израстване.

В допълнение към рамката, проектът разработи и четири изчерпателни предложения за професионални профили, които са от решаващо значение за успешното прилагане на приобщаващо STEAM образование в началните училища. Тези предложения за професионални профили са разработени въз основа на първоначалните предложения за професионални профили от проекта STEAMonedu Erasmus+. STEAMonedu послужи като основен ресурс и справка за разработването на тези профили, предоставяйки ценна представа за ролите и отговорностите на преподавателите в контекста на STEAM образованието.

Четирите профила включват следните роли:

а) Начален учител в приобщаващо STEAM образование: Този профил очертава специфичните отговорности и задължения на преподавателите, които интегрират приобщаващи STEAM практики в своите класни стаи в начален етап на образованието.

б) Ресурсен учител в приобщаващо STEAMобразование: Този профил очертава ролите и отговорностите на преподавателите, специализирани в подкрепа на ученици със специални образователни потребности в контекста на приобщаващото STEAM образование.

в) Помощен учител в STEAMобразование: Този профил предоставя подробни описания на ролите и отговорностите на учителите в подкрепа на обучението за насърчаване на приобщаващото STEAM образование, включително техните съвместни взаимодействия с други преподаватели.

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г) Експерт по приобщаваща STEAM педагогика: Този профил се фокусира върху лица, които притежават специализиран опит в приобщаващата STEAM педагогика, подчертавайки тяхната съществена роля в насочването и подкрепата на преподавателите при прилагането на ефективни подходи за обучение.

Тези професионални профили не само изясняват отделните отговорности на всеки преподавател в приобщаващото STEAMобразование в начален етап, но също така предлагат насоки за възможна динамика на сътрудничество и схеми на обучение. Освен това профилите са в съответствие с EQF (нивото на Европейската квалификационна рамка и предлагат нови кодове за включване в таксономията на ESCO (Европейски умения, компетенции, квалификации и професии).

И накрая, по отношение на новата Рамка за компетентностите на преподавателите в STEAM образованието, тя ще послужи като крайъгълен камък на следващите работни пакети на проекта, предоставяйки основните насоки и структура, необходими за проектиране на ефективни инициативи за обучение, които повишават компетентността и експертния опит на ресурсените учители в приобщаващотоSTEAM образование.

Executive summary (SP)

En los últimos años, la educación inclusiva y la educación STEAM se han convertido en enfoques educativos muy influyentes que han suscitado una gran atención y compromiso por parte de las comunidades educativas y científicas de todo el mundo. Esta mayor atención ha dado lugar a investigaciones académicas sobre las definiciones fundamentales de cada enfoque, con el fin de establecer marcos conceptuales claros. Además, los estudios han explorado las necesidades específicas y los retos a los que se enfrentan los educadores en los ámbitos de la educación inclusiva y STEAM. Por otra parte, se han realizado esfuerzos para desarrollar programas de formación especializados que doten a los educadores de

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los conocimientos y habilidades necesarios para emplear eficazmente las metodologías de la educación inclusiva o STEAM.

A pesar de que se han realizado numerosas investigaciones sobre cada enfoque por separado, existen pocas pruebas de que se puedan combinar, y los investigadores subrayan que la inclusión de los estudiantes con discapacidad en la educación STEAM sigue siendo un sueño lejano. Con el fin de profundizar en este último aspecto, los socios de los cuatro países diferentes (Bulgaria, Chipre, Grecia y España), que forman el consorcio del proyecto Erasmus+ SpicE, han contribuido a a) la descripción de la situación actual de la educación STEAM inclusiva en sus países y b) la conceptualización de las dimensiones importantes de la educación STEAM inclusiva en la tarea 2.1 del proyecto anterior (en el Análisis de Carencias o *GAP Analysis*).

La presente tarea supone integrar los resultados de la revisión bibliográfica con los nuevos conocimientos adquiridos. Esta amalgama tenía como objetivo facilitar un análisis exhaustivo de las necesidades y retos de los educadores en relación con la educación STEAM inclusiva. A través de varios pasos metodológicos, incluyendo el análisis y la síntesis de datos, hemos desarrollado el Marco de Competencias de los Educadores STEAM Inclusivo. Además, de conformidad con las normas de la ESCO, hemos formulado propuestas específicas de perfiles profesionales.

El Marco de Competencias Inclusivo para Educadores STEAM se ha desarrollado como una extensión del Marco de Competencias para Educadores STEAM que se había desarrollado en el proyecto Erasmus+ STEAMonedu. Consta de cinco (5) perspectivas, dieciséis (16) áreas de competencia, cuarenta y dos (42) competencias y varias declaraciones de competencias, que describen en detalle lo que los educadores deben ser capaces de hacer para tener éxito en un entorno educativo STEAM inclusivo y lo que deben saber y hacer para adquirir cada capacidad. El marco se ha diseñado deliberadamente para cumplir dos funciones principales:

- ✓ una herramienta de autoevaluación que permite a los educadores valorar sus propios conocimientos e identificar las competencias específicas que deben

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mejorar. Este proceso de autoevaluación permite a los educadores mejorar su eficacia en el contexto de la educación primaria STEAM inclusiva.

- ✓ una guía y herramienta de evaluación para formular y valorar los resultados del aprendizaje en programas de formación específicos. Diseñado específicamente para apoyar y desarrollar a los educadores en el ámbito de la educación primaria STEAM inclusiva, el marco garantiza que los programas de formación se ajusten a las competencias necesarias y faciliten el crecimiento profesional continuo.

Además del Marco, como parte del proyecto también se han desarrollado cuatro propuestas integrales de perfiles ocupacionales fundamentales para el éxito de la implementación de la educación STEAM inclusiva en las escuelas primarias. Estas propuestas de perfiles ocupacionales se desarrollaron a partir de las propuestas iniciales de perfiles ocupacionales del proyecto STEAMonedu Erasmus+. STEAMonedu sirvió como recurso fundamental y referencia para el desarrollo de estos perfiles, proporcionando valiosos conocimientos sobre las funciones y responsabilidades de los educadores en el contexto de la educación STEAM.

Los cuatro perfiles abarcan las siguientes funciones:

a) Profesor/a de primaria de STEAM inclusivo: Este perfil delinea las responsabilidades y deberes específicos de los educadores que integran prácticas STEAM inclusivas dentro de sus aulas de primaria.

b) Profesor/a de educación primaria con necesidades educativas especiales STEAM: Este perfil describe las funciones y responsabilidades de los educadores especializados en el apoyo a alumnos con necesidades educativas especiales en el contexto de la educación STEAM inclusiva.

c) Profesor/a de apoyo al aprendizaje STEAM inclusivo: Este perfil ofrece descripciones detalladas de las funciones y responsabilidades de los profesores/as de apoyo al aprendizaje en el fomento de la educación STEAM inclusiva, incluidas sus interacciones de colaboración con otros educadores.

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d) Experto/a en pedagogía STEAM inclusiva: Este perfil se centra en las personas que poseen conocimientos especializados en pedagogía STEAM inclusiva, destacando su papel esencial a la hora de orientar y apoyar a los educadores en la aplicación de enfoques pedagógicos eficaces.

Estos perfiles ocupacionales no sólo aclaran las distintas responsabilidades de cada educador en un aula primaria STEAM inclusiva, sino que también ofrecen orientación sobre posibles dinámicas de colaboración y esquemas de instrucción. Además, los perfiles se alinean con el EQF (Marco Europeo de Cualificaciones) y proponen nuevos códigos para su inclusiónen la taxonomía ESCO (European Skills, Competences, Qualifications, and Occupations).

Por último, y en relación con el nuevo Marco Inclusivo de Competencias de los Educadores STEAM, servirá como base de los próximos paquetes de trabajo del proyecto, proporcionando la orientación y la estructura esenciales necesarias para diseñar iniciativas de formación eficaces que mejoren la competencia y la experiencia de los Educadores Primarios STEAM Inclusivos.

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Abstract

The current deliverable has two main aims: the first is to describe the designing and developmental procedure of Inclusive STEAM Primary Educators' Competence Framework, while the second is to present the designing and developmental procedure of Inclusive STEAM Primary Educator occupational profiles.

The introduction provides the scope of the deliverable, its importance and its contribution towards the project's objectives. It, also, describes the primary outcomes and its coverage both in the time and educational context of the project.

Chapter 2 presents the need for the development of a Competence Framework for Inclusive STEAM Educators.

Chapter 3 offers an overview of the preceding research endeavours carried out within the Erasmus+ project STEAMonEdu (https://steamonedu.eu/), along with the Competence Framework for STEAM Educators (Spyropoulou & Kameas, 2020) which was the basis for the development of the new.

Chapter 4 describes the methodology and the timeline utilized to develop and validate the Inclusive STEAM Primary Educators' Competence Framework.

Chapter 5 presents in detail the implementation of methodological steps for the development and revision of the initial version of Inclusive STEAM Primary Educators' Competence Framework along with their results.

Chapter 6 presents, in detail, the methodological steps that were implemented for the validation of the revised version of Framework, produced from the previous step, along with their results.

Chapter 7 presents the final version of Inclusive STEAM Primary Educators' Competence Framework based on its validation.

Chapter 8 describes the need for the development of Inclusive STEAM primary educators' job profiles, along with the methodology used for the development of such profiles and its results.

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Chapter 9 presents the validated Inclusive STEAM primary educators' occupational profiles.

Finally, Chapter 10 sums up all the basic results of the deliverable.

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1. Introduction

The Inclusive STEAM Primary Educators' Competence Framework and profile(s) for Special Needs are two of the main objectives of WP2 "Development of SpicE Strategy for STEAM in Special Education".

The implementation methodology consists of a variety of research techniques (e.g. desk research, asynchronous roundtables, exploratory interviews and qualitative surveys) that were instrumented among the community members and the consortium of the project. The methodology focuses on developing an Inclusive STEAM Primary Educators' Competence Framework and the profile descriptions for Inclusive STEAM Primary Educators. To achieve this, the initial STE(A)M Educators' Competence Framework, one of the results of the Erasmus+ project STEAMonEdu (Spyropoulou & Kameas, 2021b), served as a foundation, with necessary adaptations and modifications implemented to ensure compatibility with Inclusive STEAM primary education settings. Moreover, the job profiles proposed by the same Erasmus+ project STEAMonEdu served, also, as a foundation and research tool for the development of the new profiles for Inclusive STEAM primary educational settings, with the latter to incorporate competences outlined in the newly formulated framework.

Those new job profiles proposals are compatible with ESCO and mapped to the European Qualifications Framework (EQF) and National Qualifications Frameworks (NQFs), factor that reassures their alignment with the standardized European system for categorizing skills, competences, and occupations. This alignment, also, allows the easier recognition and comparability of the skills and competences required for Inclusive STEAM Primary Educators across European countries, providing a common reference point for qualifications across Europe.

On the other hand, the Inclusive STEAM Primary Educators' Competence Framework developed has a twofold purpose. Firstly, it may serve as a valuable self-assessment tool, enabling primary educators to evaluate their own competences and identify specific areas for improvement, empowering them also to enhance their skills and knowledge, in order to effectively implement Inclusive STEAM education

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practices. Secondly, the Competence Framework can act as a guide for formulating the learning outcomes of specific training programs. In fact, by aligning training programs with the Competence Framework, educators can ensure that the content and objectives of the training align with the desired competences outlined in the framework. Furthermore, the Competence Framework serves as an assessment tool for evaluating the effectiveness of the training programs, enabling educators to gauge their progress and proficiency in meeting the outlined competences.

The Inclusive STEAM Competence Framework will be utilized within the project as a fundamental resource for developing a comprehensive professional development program for Inclusive STEAM Primary Educators together with the other results from the WP2 (GAP Analysis and Educational framework for STEAM in Special Education). The professional development program will encompass various components, including a blended course, teachers' mobility opportunities, and a Massive Open Online Course (MOOC), as will be outlined in Work Packages 4 and 5. The Competence Framework will serve as the cornerstone of this program, providing the essential guidance and structure needed to design effective training initiatives that enhance the competence and expertise of Inclusive STEAM Primary Educators.

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2. Background for the Competence Framework

2.1. The need

In the era of the 21st century, inclusive education has become a need in the educational context (Udeme & Nneka, 2016), promoting a modern school for all the students that will engage diversity and facilitate learning and multidimensional development for all its population (UNESCO, 1994). Consequently, students with mild disabilities have become to be vastly included in general classrooms[1], running the risk of marginalization due to their difficulties in reaching schools' normative views of ability (Hickey, 2020) and opposing significant and multifaceted challenges on educators (Beaton, Thomson, Cornelius, Lofthouse, Kools, & Huber, 2021).

In addition to such change, STEAM education, as an evolution of STEM with the addition of Arts (McKeown, 2019), has started to become a core teaching approach, due to the new skills required for the future citizens from national and international economies and workplaces (Singh, 2021). Nevertheless, such educational shift has, also, started to oppose significant challenges on educators (Herro, Quigley, & Cian, 2017; Milara & Cortes, 2019; Spyropoulou & Kameas, 2020a).

The combination of those two modern educational shifts has just started to be scientifically researched, with little evidence to exist, nevertheless, referring to the educators' challenges and even less to a joint framework. Thus, the main knowledge already existing about the first parameter comes from the D.2.1 of our Erasmus+ SpicE Project (University of Macedonia, 2023), the Erasmus+ project Steam4SEN (Steam4SEN, 2019), which mainly addresses the challenges referring to secondary

[1] https://nces.ed.gov/programs/digest/d21/tables/dt21_204.60.asp

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inclusive education and the Scientix paper of Milanovic et al. (2023) about Inclusive STEM environments. In addition, and as for the second parameter, the Universal Design for Learning has been mainly suggested as a curriculum design framework for Inclusive STEAM education (Basham & Marino, 2013), without further recommendations, nevertheless, to exist of how such framework could be translated into educators' competences for Inclusive STEAM primary education settings.

As it becomes apparent, a lot of research should be made in the combination of both fields, with the current deliverable of Erasmus+ project SpicE to come to shed more light in such research gap.

2.2. Definitions

2.2.1. Inclusive Education

Inclusive education, as a need of the past few decades, has been mainly introduced by UNESCO's Salamanca Statement of 1994, according to which, "*ordinary schools should accommodate all children, regardless of their physical, intellectual, social, emotional, linguistic or other condition*" (UNESCO, 1994).

According, also, to such Statement, "*inclusive schools must recognize and respond to the diverse needs of their students, accommodating both different organizational arrangements, teaching strategies, resource use and partnerships with the community*" (UNESCO, 1994), integrating, in parallel, child- centered pedagogies and becoming "*the ground for a people-oriented society that respects both the differences and the dignity of all human beings*" (UNESCO, 1994).

This statement, along with the No Child Left Behind Act of 2002, has opened the ground for a massive amount of research regarding the conceptualization of Inclusion, the challenges it occurs, the educators' training that is required and the means and processes for its proper implementation (Claes, 2021). Despite such research, its main added value was the opportunity it gave to population with mild disabilities to attend classrooms of general schools, along with non-disabled colleagues.

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2.2.2. Student population with Mild Disabilities

The student population with mild disabilities, such as mild intellectual disabilities, learning disorders, Attention Deficit- Hyperactivity Disorders and mild emotional and behavioral difficulties, is a quite academically intriguing study sample, as the majority of such disabilities have been mainly characterized as "hidden" or "invisible" (Sweet, 2018). Thus, and according to Sweet (2018) "*hidden or invisible disabilities are those that are not readily apparent to the observer and encompass a wide array of conditions*" (p. 69), with their manifestation of symptoms and difficulties not being able to be noticed without previous experience and knowledge (Hickey, 2020). Nevertheless, the difficulties exist and could manifest with problems in fields such as reading, writing, spelling, mathematics, self- regulatory behaviors, social perception and social interaction (Thakran, 2015; Lindblad, 2013), with the extent and the intervention methods needed to strongly depend on the initial disability as well as the co-existence of other disabilities or problems (Lindblad, 2013).

Thus, students with mild disabilities are more prone to marginalization due to their difficulties in reaching the normative views of ability that school systems have established (Hickey, 2020), with teachers to be mainly unaware of the barriers that students face, failing to provide them with reasonable adjustments (Hickey, 2020). As a consequence of teachers' lack of awareness, students would be in further risk to adjust to the increasing requirements of more complicated skills that modern society requires.

2.2.3. STEAM Education

A lot of research has been occurred in the last decades regarding the new skills requirements of labor market in the era of the 21st century. Thus, and according to Gu & Belland (2015) every future citizen *"needs to acquire adequate scientific knowledge and skills to be competitive in the job market, and be scientific literate in everyday contexts*" (Gu & Belland, 2015, p. 39), whereas, he/ she should, also, be "*a person possessing flexible, open-minded thinking and artistic sensibilities that can lead changes in the future society while creating new values in the changing times*" (Park, 2021, p. 925). In order that such skills would be acquired and developed, five

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core disciplines seem to intervene and to be crucial in such process, and these are simply science, technology, engineering, arts and mathematics.

In fact, the practical interpretation, manipulation and combination of knowledge of those five disciplines tend to largely influence the advances of global economy (Davis, 2014) and the sustainability of leadership within a constantly changing globalized world (Kelley & Knowles, 2016) and for this reason, a strong shift of interest has occurred in them from both labor market (Tyson, Lee, Borman, & Hanson, 2007) and education systems all over the world.

Consequently and as for the education, STEAM (Science, Technology, Arts, Engineering, Mathematics), as an evolution of STEM (Science, Technology, Engineering, Mathematics) with the addition of Arts has been introduced more recently in order to *"provide students with an authentic learning experience which includes tasks with a real-world context, well-defined problems, complex or multistep questions, multiple ways to approach a problem, integrate across the disciplines and have failure and iterations built into the assignment itself"* (Spyropoulou, Wallace, Vassilakis, & Poulopoulos, 2020, p. 1).

Nevertheless, and despite such well defined STEAM Education's scope, various definitions exist (Yakman & Lee, 2012; Zamorano-Escalona, García-Cartagena, & Reyes-González, 2018; Aguilera & Ortiz-Revilla, 2021), among educators and researchers, often shaped by different cultural, institutional, and disciplinary perspectives. In this research, we adopt a specific definition of STEAM education, where the "A" in STEAM represents "All other subjects" such as arts, humanities, or any other subject area. This definition emphasizes the deliberate selection of standards, content areas, and topics from at least two disciplines from STEM, including at least one subject from all other areas, to create meaningful connections. STEAM education involves instructional activities that integrate the STEM fields and "All other subjects" across all educational levels and types, serving as entry points for fostering student inquiry, dialogue, and critical thinking.

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2.2.4. Educators' training and Competence Frameworks

In such a challenging context from the scope of modern society's increasing needs, educators' continuous training seems to be a one way road, in order that teachers could compensate with their everyday teaching duties (Kinuthia & Kabui, 2020). In fact, teachers' education and professional development has become a prominent topic of policy discussion worldwide (Kaiser & Konig, 2019), with lots of implications that their professional development and training attendance strongly affects their students' academic achievements and outcomes (Valiandes & Neophytou, 2018; Basma & Savage, 2018), along with the quality of their teaching instructions (Fischer, et al., 2018). Consequently, a great variety of learning courses have been implemented worldwide, concerning every possible discipline that could create barriers or challenges to teachers' population, whereas sets of guidelines in various topics have been published for further teachers' support.

In such a scope, the term of "competences" has started being mainly used in the educational research, with its meaning to vary according to the context and the agreements that have been made. In addition, Teachers' Competence Frameworks have started to be developed by different stakeholders in order to support teachers in self-assessment and professional development in various areas and disciplines. In this research, "competences" represent educators' ability to use knowledge, skills and personal, social and/ or methodological abilities in work or study situations and professional and personal development, describing "**what educators should be able to do**". In addition, the Competence Framework is a completed Framework describing in detail the competences that an educator should have in a specific educational context, including the knowledge and skills that are aligned with such abilities.

2.2.5. Educators' training and Competence Frameworks in Inclusive STEAM Education

Despite the efforts on development of various teachers' training programs and competence frameworks, little evidence exists about those two parameters in Inclusive STEAM Education. More specifically, and according to literacy, low self-

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efficacy among teachers still remains in inclusive education instructions (Kiel, Braun, Muckenthaler, Heimlich, & Weiss, 2020) and STEAM instructions (Moon, 2020; Pant, Luitel, & Pant, 2020; Perignat & Katz-Buonincontro, 2019), whereas "*the inclusion of children with special needs in STEAM still seems to be a distant dream*" (Tomar & Vineeta, 2020, p. 95).

Nevertheless, the value of educators' training in either inclusion (Seçer, 2010; Kosko & Wilkins, 2009; Moore, 2015) or STEAM (Wong, Bui, Fields, & Hughes, 2022; Boice, Jackson, Alemdar, Rao, Grossman, & Usselman, 2021; Conradty & Bogner, 2020) has, also, been underlined by various researchers, with significant less evidence to exist for Inclusive STEAM Education (Fonseca, et al., 2022). Finally, and as for the Competence Frameworks, although Inclusive STEAM Educators' Competence Frameworks have not, yet, been developed, nevertheless, through a literature review various Inclusive/ Special Education Educators' Competence Frameworks could be found, with one STEAM Educators' Competence Framework to also exist and to have been developed by Spyropoulou & Kameas (2021b).

3. The STEAMonedu Educators' Competence Framework

The STE(A)M Educators' Competence Framework of the STEAMonEdu Erasmus+ project (Spyropoulou & Kameas, 2021) was the first completed Framework referring to educators' competences for STEAM Education. It had been developed as a main result of the project in which five different countries (Greece, Italy, Span, Germany and Belgium) had contributed as partners. The design and implementation procedure of the Framework had been based on multi-stage methodology, including the Delphi technique. During the validation of the framework more than 300 stakeholders from the entire world participated in this process.

The STE(A)M Educators' Competence Framework consisted, starting from its highest level to lowest levels, of:

- Perspectives, which represented the different roles that educators have in the educational system

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- Competence areas, which represented the different dimensions of educators' roles within the educational system
- Competences, which represented educators' ability to use knowledge, skills and personal, social and/ or methodological abilities in work or study situations and professional and personal development, describing "**what educators should be able to do**" and
- Examples of Competences' statements (Spyropoulou & Kameas, 2021b).

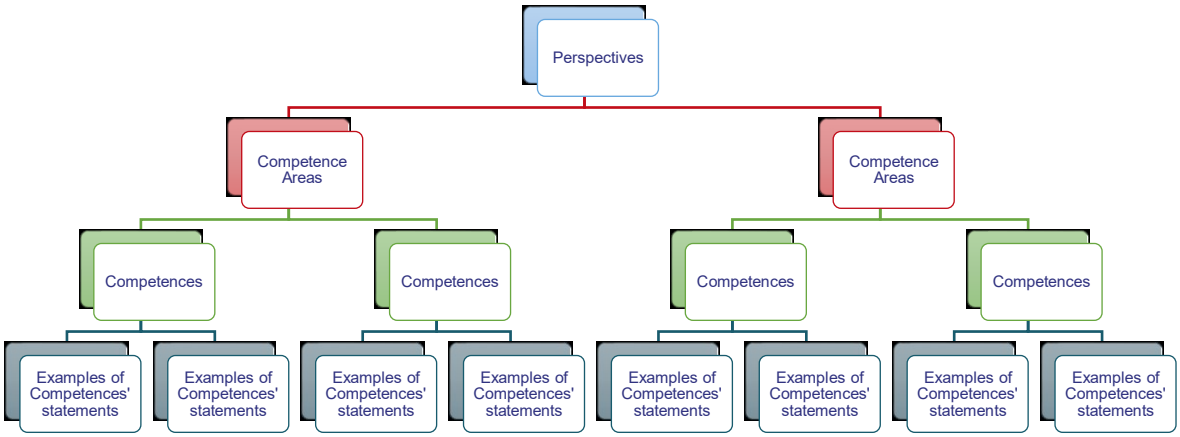

Figure 1: Structure of STE(A)M Educators' Competence Framework of Spyropoulou&Kameas (2021b)

The final STE(A)M Educators' Competence Framework had five different perspectives-roles, which were those of:

- Educator as a teacher- trainer- tutor, which included all the required educators' competences during the implementation of an educational procedure
- Educator as a learning designer and creator, which included all the required educators' competences related to planning, preparing and developing of STE(A)M related learning processes
- Educator as an orchestrator, which included all the required educators' competences related to managing and orchestrating resources and participants

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- Educator as a community member, which included all the required educators' competences related to interacting and engaging with different communities and to applying policies and
- Educator as a professional, which included all the required educators' competences related to their professional development along with the transferable and digital skills needed during STE(A)M-related activities (Spyropoulou & Kameas, 2021b).

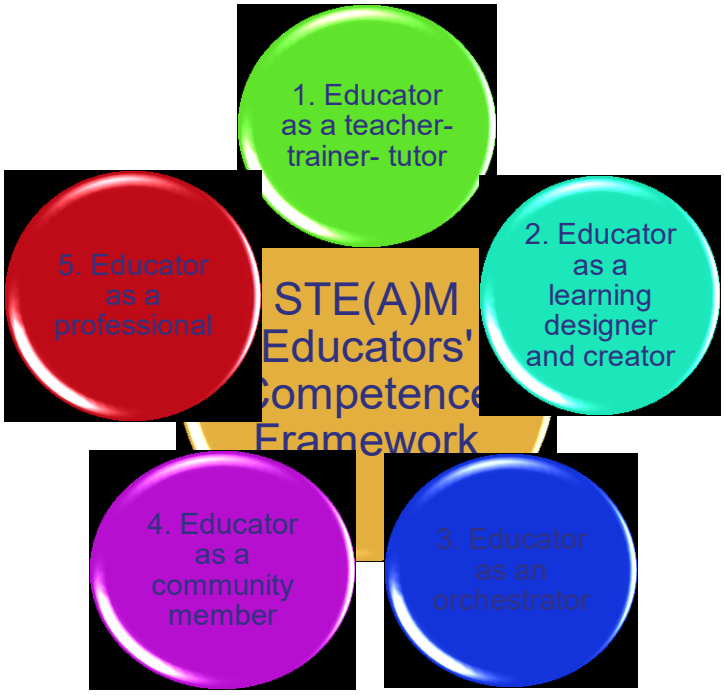

Figure 2: Educators' roles within the STE(A)M Educators' Competence Framework (Spyropoulou & Kameas, 2021b)

In addition, fourteen (14) competence areas had been proposed along with forty four (44) competences within the Framework, with its final version to be presented on Annex 1.

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4. Methodology and timeline for the development of Inclusive STEAM Educators' Competence framework

In order for the initial STE(A)M Educators' Competence framework to be adapted for Inclusive STEAM settings, the methodology was the first to be selected. Thus, and after thorough research, the methodology followed by Fong, Ch'ng & Por (2013) was selected with slight modifications in order to align with the specific timeline and requirements of the project.

4.1. Methodology

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Consequently, for the development of the initial draft of Inclusive STEAM Educators' Competence Framework, five steps from the initial methodology proposed by Fong, Ch'ng & Por (2013) were implemented, and those were:

1. the analysis of educators' needs concerning inclusive STEAM/STEM
2. the analysis of existed STEAM/ STEM, General/ Inclusive/ Special Education Teachers' Competence Frameworks
3. a literature review
4. exploratory interviews and
5. a pilot study

Afterwards, and for the revision and validation of the Inclusive STEAM Educators' Competence Framework, five more steps from the initial methodology proposed by Fong, Ch'ng & Por (2013) were implemented and those were:

6. the implementation of two asynchronous online roundtables with the participation of all project partners and of a meeting for further feedback and reflection on its components
7. the development of the revised Inclusive STEAM Educators' Competence Framework as a Round 1 Questionnaire for Delphi panel along with the questions about its components for reflection
8. the formation of Delphi panel with the contribution of all project partners
9. the implementation of the modified Delphi technique in three rounds with participants from the four countries and
10. the development and distribution of the validated Inclusive STEAM Educators' Competence Framework to all participants and project partners.

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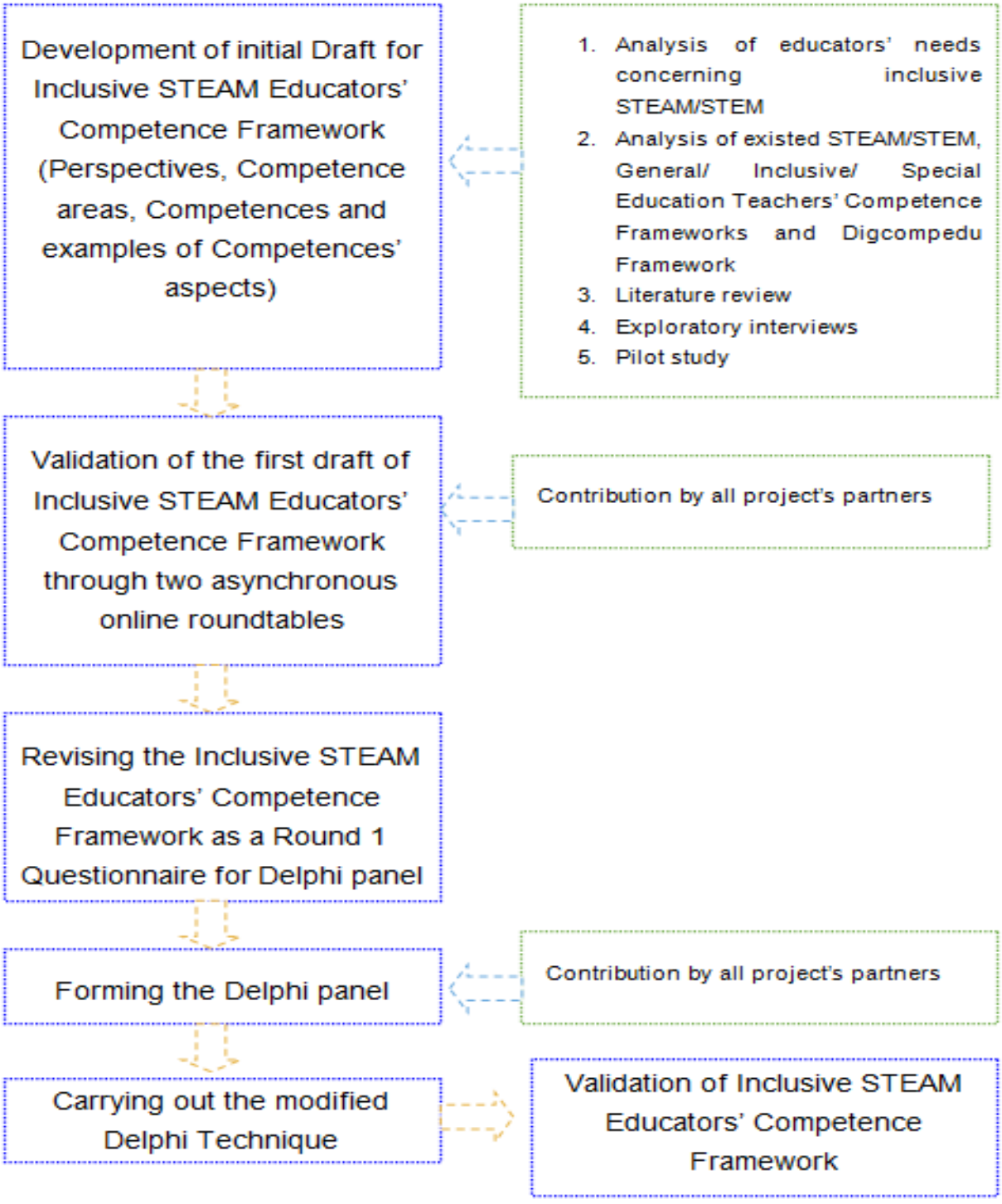

Figure 3: Methodology for the development and validation of Inclusive STEAM Educators' Competence Framework

4.2. Timeline

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Those steps had been distributed to a time span of eight months, with little adaptations from the original timeline to have been made due to special occasions, such as the different dates of Easter holidays in each partner's country. The results from each of the above methodological steps would be described in detail in the next two chapters.

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5. Development of the first draft of Inclusive STEAM Educators' Competence Framework

For the development of the first draft of Inclusive STEAM Educators' Competence Framework, the first six steps from the described methodology (in chapter 4) based on that of Fong, Ch'ng & Por (2013) were implemented.

Those steps had been distributed in a time span of five months, with the contribution of all project partners being vital for the completion of the whole procedure. In addition, and as the main approach of project SpicE is "from the Community and to the Community", the involvement of the community and of their needs was the first priority in almost all the stages of the procedure.

Step 1: Analysis of educators' needs concerning Inclusive STEAM/STEM

Consequently, the first step of the methodology was the analysis of educators' needs. In such step, the contribution of all project partners in the Task 2.1 (University of Macedonia, 2023) of Erasmus+ project SpicE was significant, due to the lack of literacy concerning the Inclusive STEAM Education. In that Task, an online survey was implemented through questionnaires in pre-service and in-service primary education teachers of all four participating countries (Bulgaria, Cyprus, Greece and Spain). From the survey and from the literature review implemented in national and international level from project partners and the leaders of the Task 2.1, who were from the University of Macedonia (2023), several educators' needs were revealed and could be seen in the following table:

Table 1: Pre-service and in-service teachers' needs concerning Inclusive STEAM Education, revealed by project SpicE Task 2.1.

Pre-service and in-service teachers' needs concerning Inclusive STEAM Education, revealed by project Spice's Task 2.1.	
Sp1.	Needs for practical solutions for the educational inclusion of students with Mild Disabilities (both pre-service and in-service teachers)

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Sp2.	Instructional methodology needs for students with Mild Disabilities (both pre-service and in-service teachers)
Sp3.	Educational assessment needs for students with Mild Disabilities (both pre-service and in-service teachers)
Sp4.	Needs for the ascertainment of all students' school progress (both pre-service and in-service teachers)
Sp5.	Instructional methodology needs for each of the STEAM fields (both pre-service and in-service teachers)
Sp6.	Needs for adapting the general school curriculum to the needs of students with Mild Disabilities (both pre-service and in-service teachers)
Sp7.	Needs for ideas for incorporating STEAM Education in the daily school practice (both pre-service and in-service teachers)
Sp8.	Needs for integrating multiple learning goals from different content areas (both pre-service and in-service teachers)
Sp9.	Needs in the organization of integrated STEAM lessons (both pre-service and in-service teachers)
Sp10.	Needs for using STEAM education as context for including students with Mild Disabilities in the learning activities of the general classroom (both pre-service and in-service teachers)
Sp11.	Needs in the theoretical background of STEAM Education (both pre-service and in-service teachers)
Sp12.	Needs for appropriately motivating teachers and students participating in inclusive STEAM programs (pre-service teachers)
Sp13.	Needs for properly adapting the facilities in which inclusive STEAM programs take place (pre-service teachers)
Sp14.	Needs for enhancing the socio-emotional dimensions of teaching (values, respect, acceptance, empathy) (pre-service teachers)
Sp15.	Needs for using STEAM Education for increasing disability awareness (pre-service

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	teachers)
Sp16.	Training needs in how to include students with Mild Disabilities alongside students with other disabilities (pre-service teachers)
Sp17.	Needs for the enhancement of Arts' presence in the context of Inclusive STEAM programs (both pre-service and in-service teachers)
Sp18.	Needs for more spacious STEAM classrooms (in-service teachers)
Sp19.	Needs for enrichment of initial teacher's education with STEAM courses (in-service teachers)
Sp20.	Needs for employment of speech therapists, psychologists and other specialists for the support of teachers' implementing STEAM for students with disabilities (in-service teachers)
Sp21.	Needs for family involvement in STEAM Education programs (in-service teachers)
Sp22.	Needs for the reduction of the case load in primary schools (in-service teachers)
Sp23.	Needs for access to free tools for the implementation of STEAM activities (in-service teachers)
Sp24.	Need to address separately the needs of small schools (in-service teachers)

In addition to those results, significant was the finding of pre-service and in-service primary education teachers' restricted knowledge of STEAM Education, Inclusive Education and Inclusive STEAM Education, along with their significant need of further training in all those approaches. This lack of knowledge along with teachers' significant need of further training, was an initial indicator of the level of detail that a Competence Framework which would combine the two educational approaches should have. In order that the results and indicators from Erasmus+ project SpicE would be further examined, a desk research concerning pre-service and in-service primary and secondary teachers' needs and/ or challenges for Inclusive STEAM Education was implemented through the Scopus and Academia.edu databases and Google and Google scholar search engines.

Some initiatives from such research were the results from the Erasmus+ project Steam4SEN (2019), which aims to enhance schools' capacity to provide Inclusive

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and efficient STEAM education to students with special educational needs (SEN). In such project, qualitative surveys were implemented in secondary education teachers of six participating countries (Italy, Lithuania, Portugal, Malta, Bulgaria and Greece), in order that the challenges they face concerning the implementation of Inclusive STEAM Education for students with SEN would be revealed. In addition to this research, the research of Milanovic et al. (2023) which focused on challenges of supporting Inclusive STEM learning environments was, also, analyzed. Tables 2 and 3 present the challenges and needs that were identified in these two investigations.

Table 2: In-service secondary teachers' needs concerning STEAM Education, revealed by Erasmus+ project STEAM4SEN (2019, p.p. 9-10)

In-service secondary teachers' needs concerning STEAM Education, revealed by Erasmus+ project STEAM4SEN	
S4S_1.	Lack of innovative teaching. Teachers do not apply or adapt different tools to include all learning, pedagogical skills and teaching methods
S4S_2.	Lack of individually planned and systematically controlled teaching process in STEAM Education for children with SEN
S4S_3.	Division of students according to gender, culture and learning styles
S4S_4.	Lack of education methods in terms of knowledge assessment along with abilities and competences
S4S_5.	Lack of multi-disciplinary and collaborative teaching approaches especially in regards to SEN students
S4S_6.	STEAM is being viewed as a series of hands-on tasks during certain events
S4S_7.	Lack of STEAM experts at school that could help teachers or special education teachers to develop STEAM pedagogies which are more relevant to SEN students
S4S_8.	Lack of suitable infrastructure, facilities and technical support to assist students with SEN
S4S_9.	Not enough time
S4S_10.	The learning environment is not conductive to mutual learning and support between children and adults

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S4S_11.	Lack of flexibility in curricula to enable lecturers to use a variety of teaching methods
S4S_12.	Lack of teachers' training to acquire the appropriate skills and knowledge to successfully meet the modern demands of the STEAM community
S4S_13.	Lack of teachers' motivation for professional development and in-depth understanding of STEAM subjects
S4S_14.	Teaching STEAM is more theoretical
S4S_15.	There is a large gap between the material taught and the language used in today's reality. Classroom discussions are characterized by a profound linguistic divide
S4S_16.	STEAM and Robotics are currently not part of the curriculum in compulsory education
S4S_17.	Lack of appropriate educational and digital resources/ techniques, software programs, games in STEAM and Robotics specifically for students with SEN
S4S_18.	Lack of students' experience in educational resources
S4S_19.	Lack of specific scientific research on the relationships between students with SEN and STEAM approaches
S4S_20.	Lack of connection between the school and work (real-life) environments
S4S_21.	Lack of focus on the skills, jobs and careers of the future

Table 3: Educators' challenges on supporting Inclusive STEM learning environments (Milanovic, et al., 2023, pp. 8-11)

Educators' challenges on supporting Inclusive STEM learning environments	
M1.	Educators' bias against inclusivity
M2.	Gender barriers
M3.	Socio-economic barriers with students from low-income backgrounds and ethnic minorities
M4.	Language barriers in terms of scientific terminology
M5.	Poor infrastructure and lack of assistive technologies

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M6.	Lack of teachers' training and inability of use of assistive technology
M7.	Lack of time and motivation in order that teachers include STEM education
M8.	Lack of accessibility in buildings, labs and materials for students with disabilities

The challenges identified by the Erasmus+ project Steam4SEN (2019) and Milanovic et al. (2023) paper were critically reviewed with the educators' needs revealed by the Erasmus+ project SpicE (University of Macedonia, 2023). Afterwards all the needs and challenges were grouped into categories and aligned with the roles of educators that had been presented in the original STEAM Educators' Competence Framework. The result of such process was a first indicator of the needed competences' areas, competences and competences' statements that should be added in the new framework.

Step 2: Analysis of existing teachers' Competence Frameworks

In the next step of the methodology, already existing teachers' Competence and Educational Frameworks and related material were identified and selected, in order to be analyzed through the aspects of:

a. whether or not they had proposed competence areas, competences or competences' statements concerning the educators' needs identified in the first step and in which way and
b. what other core competences had proposed concerning Inclusion.

The selection of the Competence and Educational Frameworks concerning general education teachers' competences, Special/ Inclusive Education teachers' competences and STEAM Education teachers' competences had followed specific criteria. Those criteria were the following:

1. frameworks/ related material to be written in English language
2. frameworks/ related material to be written by countries' Ministries of Education and Councils
3. frameworks/ related material to be written by European, National or International Agencies/ Organizations/ Committees/ Universities

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4. frameworks/ related material to be deliverables of Erasmus+ projects
5. frameworks/ related material to be published in scientific journals
6. frameworks/ related material to cover the world geographically
7. frameworks/ related material to refer to all STEAM/STEM disciplines and
8. frameworks/ related material to have been published in the last twenty years.

As a result of such criteria, eleven Competence and Educational frameworks/ related material referring to general educators' competences, four frameworks referring to special/ inclusive educators' competences and six related materials (research papers) referring to STEAM/ STEM Educators' competences had been selected in order to be critically reviewed, along with the STE(A)M Educators' Competence Framework (Spyropoulou & Kameas, 2021b). Table 4 provides the resources.

Table 4: The selected Competence and Educational Frameworks and related material for further analysis

Code	Framework/ paper name	Source
G1	Reference Framework for Professional Competences for Teachers	(Ministère de l'éducation du Québec, 2021)
G2	Teacher Competency Standards Framework	(Ministry of Education of the Government of the Republic of the Union of Myanmar, 2020)
G3	Global Teachers' key Competences Framework	(TKCOM, 2018)
G4	Southeast Asia Teachers Competency Framework	(Teachers' Council of Thailand, 2018)
G5	The Competency Frameworks: Supporting Quality Teaching in Lebanon	(Ministry of Education and Higher Education of Lebanon and the Center of Educational Research and Development, 2017)
G6	General Competencies for Teaching Profession	(Directorate General for Teacher Training and

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		Development , 2017)
G7	Competency Framework for Community School Teachers	(Ministry of General Education of Republic of Zambia, 2016)
G8	Competence profile for Primary School Teachers in Uganda	(Ministry of Education and Sports in Uganda, 2014)
G9	Danielson's Framework for Teaching (adopted by many States of America)	(Danielson, 2011)
G10	Competency Framework for Teachers	(Department of Education of the Government of the Western Australia, 2004)
G11	Generic Teacher Competencies Framework	(Advisory Committee on Teacher Education and Qualification, 2003)
SpInc1	The inclusive educator profile and competence framework	(European Agency for Special Needs, 2022)
SpInc2	The National Framework for Inclusion	(Scottish Universities Inclusion Group, 2022)
SpInc3	Competency Framework for Special Educators K-7-12	(Texas Education Agency, 2015)
SpInc4	Competencies for Special Education of the State of Arkansas	(Division of Elementary & Secondary Education of the State of Arkansas , 2015)
STM1	STEAM Competence Framework of the would-be teachers of natural science subjects	(Sologoub & Arshansky, 2021)
STM2	A generalized model of STEAM competence for teachers	(Morze & Strutynska, 2021)
STM3	Framework of evaluation indicators of Teaching Competences in STEAM Education in Korea	(Kim & Kim, 2016)
STM4	ATS STEM Conceptual Framework for Integrated STEM Education	(Butler et al., 2020)

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STM5	Competence Framework for STEM teaching	(Chien, 2019)
STM6	Indicators for evaluating the impact of Professional learning initiatives on STEM teachers' competences	(Chaimala & Kikis- Papadakis)

The analysis of the above resources gave, as a result, a series of competences and competences' statements concerning the needs of educators identified in the first step, highlighting, also, significant parameters that should be included in the new framework.

Step 3: Literature review and changes in the initial competence framework

In the next step of the methodology, the competences from the previous step of frameworks' analysis along with the educators' needs and challenges found in the first step of the methodology were critically reviewed, in order that proposed new and updated competences would be produced. Afterwards a grouping was implemented for the competences into competence areas which were in accordance with initial STEAM Educators' Competence Framework and the areas of identified educators' needs from the first step of analysis. Finally, an aligning was implemented on the perspectives to which competence areas belong. In addition, a further literature review was implemented concerning the competences found in the previous step that had not been properly conceptualized among the frameworks, for the further identification of their statements.

In addition, several competences from the initial STEAM Educators' Competence Framework were integrated into other competences of the new framework or were deleted in order to avoid overlapping. More specifically:

- ✓ the competence 1.1.3 of the initial framework was integrated into the competence 1.1.2 of the new framework as a statement
- ✓ the competences 1.1.4 and 1.1.5 of the initial framework were deleted as they were described more analytically by the competences 1.3.1 and 1.3.2 of the new framework

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- ✓ the competences 1.2.1 and 1.2.2 were integrated into the competence 1.6.3 of the new as statements
- ✓ the competence 1.3.1 of the initial framework was integrated into the competence 2.2.1 of the new framework as a statement
- ✓ the competence 1.3.2 of the initial framework was integrated into the competence 1.3.1 of the new framework as a statement
- ✓ the verb "use" of the competence 1.3.3 of the initial framework changed into "provide" and was transferred to the position 1.3.1. of the new framework
- ✓ the competence 1.4.1 of the initial framework was integrated into the competence 1.4.1. of the new as a statement
- ✓ the term "inclusion" of the initial framework was deleted due to overlapping
- ✓ the competence 1.5.3 of the initial framework was integrated into the competence 1.6.2 and 2.2.2 of the new framework as statements
- ✓ the competences 2.1.1 an 2.1.2 were deleted as they were described more analytically by the competence 2.2.1 of the new
- ✓ the competence 2.1.3 of the initial framework was deleted as it was described more analytically in the competences 2.1.2 and 2.1.3 of the new
- ✓ the competence 2.1.4 of the initial framework was integrated into the competence 2.2.2. of the new
- ✓ the competence 2.2.2 of the initial framework was deleted as it was described more analytically in the competence 1.3.2 of the new
- ✓ the competences 5.1.1-5.1.4 of the initial framework were deleted and replaced by the competences 1.5.1- 1.5.3 of the new, due to the updates in literature
- ✓ the competence 5.2.3 of the initial framework was integrated into the competence 2.2.1 of the new as a statement and
- ✓ the competence 5.2.5 of the initial framework was integrated into the competence 1.3.1 of the new.

In addition, several changes were made in the competences' statements of the initial framework and a series of new statements were introduced to the new, according to the results of the three phases of the current methodology (identification of learners'

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needs, Frameworks' analysis, and literature review). Table 5 presents the form of the newly formulated framework.

Table 5: The initially proposed competences of the new framework

Proposed Competence Areas (***based on educators' needs and challenges from the first step***)	**Proposed competences**
Educators' initial proposed competences' areas/ competences for their role as an Inclusive STEAM teacher- trainer- tutor	
1.1.Learners' profiling in Inclusive STEAM classrooms (new)	1.1.1. Assess learners ' needs (new)
	1.1.2. Analyze learners needs (new)
	1.1.3. Screening signs of disabilities (new)
	1.1.4. Develop learners' profiles (new)
1.2. Pedagogies in Inclusive STEAM classrooms (adapted)	1.1.5. Integrate learners' prior knowledge in Inclusive STEAM classrooms (new)
	1.2.1. Apply STEAM teaching and learning techniques in inclusive classrooms (adapted)
	1.2.2. Apply teamwork methods and group dynamic techniques for collaborative learning activities in Inclusive STEAM classrooms (adapted)
1.3 Inclusive STEAM resources and instructions	1.3.1. Provide appropriate resources in Inclusive STEAM classrooms (adapted)
	1.3.2. Provide appropriate instructions in Inclusive STEAM classrooms (new)
1.4 Assessment and feedback in Inclusive STEAM classrooms	1.4.1. Assess all learners' activity performance in Inclusive STEAM classrooms (adapted)
	1.4.2. Provide appropriate feedback to all stakeholders (adapted)

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1.5. Empowering learners	1.5.1. Ensure accessibility in Inclusive STEAM classrooms (adapted)
	1.5.2. Ensure all learners' active engagement in Inclusive STEAM classrooms (adapted)
1.6 Inclusive STEAM Education foundations	1.6.1. Understand the disability models (new)
	1.6.2. Demonstrate knowledge on Inclusive and Special Education (new)
	1.6.3. Demonstrate knowledge on the STEAM education approach (adapted)
	1.6.4. Understand the added value of Inclusion in STEAM
Educators' initial proposed competences' areas/ competences for their roles as an Inclusive STEAM designer and creator	
2.1. Educational Design for Inclusive STEAM Education	2.1.1. Design inclusive STEAM education curriculum of STEAM-related general and special education disciplines (new)
	2.1.2. Design lesson plans for Inclusive STEAM Education (new)
	2.1.3. Design Inclusive STEAM activities (new)
2.2. Educational Design for Inclusive STEAM resources and Instructions	2.2.1. Select appropriate resources for Inclusive STEAM education (adapted)
	2.2.2. Design and create appropriate resources and Instructions for Inclusive STEAM Education (adapted)
	2.2.3. Adapt and modify resources in order to meet all learners' needs (new)
2.3. Learners' development	2.3.1. Facilitate learners' STEAM competences
	2.3.2. Facilitate learners' inclusive competences (new)
Educators' initial proposed competences' areas/ competences for their role as an Inclusive	

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STEAM orchestrator	
3.1. Inclusive STEAM educational procedures and resources coordination	3.1.1. Apply educational resources management methods in Inclusive STEAM classrooms (adapted)
	3.1.2. Apply teaching and learning organization methods for Inclusive STEAM education (adapted)
	3.1.3. Apply teaching space management methods in inclusive STEAM classrooms (adapted)
3.2. Inclusive STEAM classroom's members coordination	3.2.1. Coordinate learners and groups of learners during inclusive STEAM related activities (adapted)
	3.2.2. Coordinate team of educators and special education staff during a collaborative inclusive STEAM teaching procedure (adapted)
Educators' initial proposed competences' areas/ competences for their role as a community member	
4.1. Community building	4.1.1. Engage in Inclusive STEAM communities of educators (adapted)
	4.1.2. Engage in institutional-based communities for Inclusive STEAM Education (adapted)
	4.1.3. Engage in research and business communities for Inclusive STEAM Education (adapted)
4.2. Application of policies	4.2.1. Implement policies that promote STEAM Education and Inclusion (adapted)
	4.2.2. Reinforce Inclusive STEAM education awareness in the educational community (learners, educators, parents etc.) (adapted)
Educators' initial proposed competences' areas/ competences for their role as a growing Inclusive STEAM professional	
5.1. Transferable skills	5.1.1. Develop and apply personal transferable skills (new)

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	5.1.2. Develop and apply social transferable skills (new)
	5.1.3. Develop and apply learning to learn transferable skills (new)
5.2. Digital skills	5.2.1. Apply information and data literacy skills
	5.2.2. Manage and use digital tools for communication and collaboration in Inclusive STEAM education
	5.2.3. Apply privacy and copyright rules in digital content for STEAM Education
5.3. Professional development	5.3.1. Adapt (self)reflective practices for Inclusive STEAM (adapted)
	5.3.2. Participate in lifelong learning related to STEAM, inclusion and inclusive STEAM educational approach (adapted)
	5.3.3. Apply action research procedures for reflection and improvement of educational procedures in inclusive STEAM Education (adapted)

Step 4: Exploratory interviews

In the next step of the methodology, exploratory semi-structured interviews were implemented among two pre-service (general and special education) primary teachers and four in-service (two general and two special education) primary teachers. The participants were selected with the use of convenience sampling technique, due to the limited time span for the conduction of the exploratory procedure.

The participants of the study were asked to read the new framework produced from the previous steps and answer the following questions:

1. Which, according to their opinion, was the best way for the ascertainment of learners' progress
2. What did they believe about the framework's components in the aspects of clarity, significance and sufficiency

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3. If they agreed on framework's structure, and if not, to explain the reasons why, and
4. If they had any additional suggestion and comment about the framework.

After answering the above questions, the participants were informed about the changes that occurred in the initial framework and were requested to reflect on whether they agreed or not.

As a result of such procedure, all the participants agreed on the changes on the initial framework and on the structure of the new framework. In addition, and as for the first question:

- ☑ five out of six participants (all except the one general in-service primary teacher) proposed the development of learners' portfolios for the ascertainment of their progress,
- ☑ four participants (all except one special and one general education teachers) proposed the publication of learners' achievements in school's web page and
- ☑ two participants (the two general primary teachers) proposed the teachers' diary.

Concerning the second question:

- ☑ all participants agreed on the clarity of framework's components
- ☑ two of the participants (one pre-service general education primary teacher and one special education primary teacher) had concerns about the significance of competences 4.1.2 and 4.1.3
- ☑ all participants disagreed with the competence 5.2.3 and
- ☑ all participants agreed with the sufficiency of the current framework, with most of them to state that all the required competences had been already described within the framework.

Finally, and as for the fourth question:

- ☑ five participants (all except one special education in-service teacher) proposed the integration of the socioeconomic and cultural dimension as an

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exclusion criterion in the analysis of learners' needs and the investigation of their origin in the statements of competence 1.1.2.

- ☑ two participants (the two special education in-service teachers) proposed the integration of the promotion of cognitive conflicts as statement of competence 1.2.1. and
- ☑ one participant (special education in-service teacher) underlined the integration of game-based learning and outdoor learning in the statement of competence 1.2.2.

As a result of the exploratory interviews procedure, small changes occurred in the framework's structure and those were:

- ✓ The removal of the competence 5.2.3. along with its aspects
- ✓ The inclusion of the new competence 1.4.3
- ✓ The inclusion of five new statements in competence 1.4.3 (Lukitasari, Hasan, Sukri, & Handhika, 2021; Lam, Wang, & Nedivi, 2020; Pounds & Cuevas, 2019; Wesson & King, 1996).
- ✓ The inclusion of the word "portfolio" in the statements of competences 1.1.1
- ✓ The inclusion of socioeconomic and cultural dimension as an exclusion criterion in the statements of competence 1.2.2
- ✓ The inclusion of the statement "to promote cognitive conflicts" in the competence 1.2.1
- ✓ The inclusion of "game-based learning" and "outdoor learning" in the first statement of competence 1.2.1.

Step 5: Pilot study

Finally, in the fifth step of the methodology for the development of the first draft of the Competence Framework for Inclusive STEAM educators, a pilot study was implemented on five STEAM primary education teachers with experience in both general and special education. The participants were selected with the use of the convenience sampling technique, due to the limited time span for the conduction of the pilot study.

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The participants of the study were asked to read the framework and, according to their opinion and experience in both general and special education context, to answer to the following questions:

1. if they agreed with the current form of framework, in the aspects of clarity, significance and sufficiency
2. what they expected to see in a competence framework and
3. if the current competence framework had reached their initial thoughts and expectations.

All of participants gave positive answers on questions 1 and 3, with their answers to be of high significance due to the correct representations and thoughts they provided on question 2. As a result of this procedure, the first draft of Inclusive STEAM Competence Framework was distributed to project partners for further evaluation and validation.

Step 6: Validation of the first draft of Inclusive STEAM Educators' Competence Framework by project partners

The evaluation and validation procedure of the first draft of the Inclusive STEAM Educators' Competence Framework was implemented, according to the used methodology, through two roundtable asynchronous discussions via the collaborative online platform "Basecamp" with the contribution of all project partners.

First asynchronous roundtable discussion

In the first asynchronous roundtable, the framework was uploaded on the collaborative online platform Basecamp, along with the survey questions concerning its components. All project partners were, then, requested to provide their comments on six questions, with the five to be common for everyone and the sixth to differ according to their affiliation. The questions that were common for all referred to the clarity, significance and efficiency of the framework's competences and competences' areas. The sixth question referred to either the way the university partners conceived a competence framework for Inclusive STEAM education or the way that the non-university partners would use such framework.

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Partners had a time span of one week to provide their comments and after this, all their comments and suggestions were processed and included in the new version of the framework. The changes that were made after such process and according to partners' suggestions were the following:

- ✓ The competence 1.1.2 was added in the competence 1.1.1 along with its statements
- ✓ One more statement was added in competence 1.1.1 (*to name important knowledge elements of the developmental process of each STEAM learning field*)
- ✓ The new competence 1.1.2. was renamed into "Screening and successfully communicating (possible) signs of disabilities"
- ✓ The word "STEAM" was added in the name of competence 1.1.3
- ✓ Two new statements (*1) to describe in detail learners' preferences, strengths, and weaknesses in reference to specific fields, goals or objectives of Inclusive STEAM Education and 2) to create an observable and measurable account of learners' learning behaviours*) were included in the competence 1.1.3
- ✓ The words "STEAM classrooms" were added in area 1.2.
- ✓ The competence 1.2.1. was renamed into "Integrate learners' prior STEAM knowledge and skills in Inclusive STEAM classrooms"
- ✓ One new statement was added in the competence 1.2.1 (*to construct new STEAM knowledge and skills on learners' prior STEAM knowledge and skills*)
- ✓ The word "Inclusive" was added in the name of competence 1.2.2
- ✓ Three new statements were added in the competence 1.2.2 (*1) to know, understand and apply Inclusive educational frameworks such as the Universal Design of learning (UDL) in Inclusive STEAM classrooms, 2) to combine STEAM teaching and learning techniques with Inclusive teaching and learning techniques (e.g. UDL, DI) for developing and delivering effective Inclusive STEAM teaching and learning and 3) produce combinations of evidence-based methods, techniques, and means for*

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achieving the goals and objectives set in the personalized instructional programs)

- ✓ The word "use" replaced the word "provide" in the name of the competence 1.3.1
- ✓ The word "apply" replaced the word "provide" in the name of the competence 1.3.2
- ✓ Two new statements were added in the competence 1.3.2 (*1) to justify the specific way the intervention has been implemented and 2) to mention alternative ways for implementing the program, provided that the necessary resources were available*)
- ✓ The competence 1.4.1 was renamed into "Assess individual learners' activity/ project performance in Inclusive STEAM classrooms"
- ✓ Two new statements were added in competence 1.4.1 *(1) to specify the extent to which the implemented Inclusive STEAM educational procedure brought about the intended change in all learners and 2) to specify the reasons for the degree of all learners' success in the Inclusive STEAM educational process*)
- ✓ A new competence was separated from competence 1.4.1 and was included in area 1.4 in the position 1.4.2 (*Assess group dynamics and interrelationships in Inclusive STEAM classrooms*)
- ✓ Three new statements derived from initial competence 1.4.1 were included in the new competence 1.4.2 (*1) to know, understand, select and apply multiple forms of group dynamics and interrelationships assessment in Inclusive STEAM activities/ projects, 2) to know, understand and be able to keep detailed and diagnostic records and data of group dynamics, performance and interrelationships assessment in Inclusive STEAM activities/ projects and 3) to analyze group's engagement, activity performance and progress in Inclusive STEAM activities/ projects*)
- ✓ Two new statements were added in the competence 1.4.3 (*1) to describe clearly the interactions prevailing in the specific learning environment among learners, curriculum, resources and other important factors or agents to all stakeholders and 2) to present detailed information of the dynamics of the classroom to all stakeholders*)

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- ✓ The word "STEAM" was added in the name of the competence 1.4.4.
- ✓ Examples were included in one statement of competence 1.4.4 and a new statement was included (*to identify and select appropriate format(s) of learners' STEAM portfolios (e.g. digital portfolios, traditional portfolios)*) for the further specification of the competence
- ✓ One statement of competence 1.6.1 was rewritten
- ✓ The statements of competence 1.6.2 were rewritten for the improvement of their clarity
- ✓ Two new statements were added in the competence 1.6.3 (*1) to name significant benefits of STEAM Education and 2) to name important advantages and disadvantages of the interdisciplinary, transdisciplinary and separate-fields approaches of STEAM Education*)
- ✓ One new statement was added in the competence 1.6.4 (*to name the main advantages of Inclusive STEAM Education and the main prerequisites for its successful application*)
- ✓ The verb "be aware of" replaced the verb "recognize" in the first statement of competence 2.1.1
- ✓ Five new statements were added in competence 2.1.1. (1) *to set documented priorities with regard to the fields on which STEAM Education will concentrate, 2) to write down clear, observable and measurable STEAM-related disciplines goals, 3) to set documented priorities with regard to the fields on which Inclusive Education will concentrate, 4) to write down clear, observable and measurable Inclusive Education goals and 5) to merge desired STEAM- related disciplines' goals and Inclusive Education's goals in order to define Inclusive STEAM Education goals*)
- ✓ The phrases "Inclusive STEAM curricula" and "using inclusive educational frameworks such as UDL" were added in the last statement of competence 2.1.1
- ✓ The competence 2.1.2 was rewritten in order to cover the new statements added
- ✓ Ten new statements were added in the competence 2.1.2 (*1) to select and write down desired Inclusive STEAM lesson's goals, 2) to convert selected Inclusive STEAM lesson's goals into specific, measurable, achievable,*

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realistic, and time-bound (SMART) Inclusive STEAM objectives, 3) to write down (SMART) Inclusive STEAM lesson's objectives for every learner according to his/ her needs and STEAM knowledge and skills, 4) to develop Inclusive STEAM lesson plan(s) by defining all learners' objectives, learning activities, assessments, lesson's sequence and timeline, 5) to select appropriate content, sequencing, breadth, balance and delivery means from the designed Inclusive STEAM curricula for the accomplishment of all learners' Inclusive STEAM objectives, 6) to develop Individual STEAM lesson plan(s) if needed by defining learner's objectives, learning activities, assessments, lesson's sequence and timeline, 7) to write down supplementary SMART STEAM and/ or Inclusive objectives for specific or all learners if needed, 8) to merge supplementary SMART STEAM and Inclusive STEAM objectives into SMART Inclusive STEAM objectives for specific or all learners, 9) to redesign Inclusive STEAM lesson, lesson's plan(s)/ Individual STEAM lesson plan(s) if needed and 10) to adapt the designed Inclusive STEAM lessons and lessons' plans to the specific instructional environment and its infrastructures)

- ✓ The word "educational" was added in the name of the competence 2.1.3
- ✓ The phrase "/projects based on Inclusive STEAM lesson plan(s) and/ or Individual STEAM lesson plan(s)" was added in the first statement of competence 2.1.3
- ✓ The word "projects" was added on all the statements of the competence 2.1.3
- ✓ One new statement was added to competence 2.1.3 (*to adapt the designed Inclusive STEAM activities to the specific instructional environment and its infrastructures*)
- ✓ The words "and adapt" were added in the name of competence 2.2.1
- ✓ The words "frameworks/ methods" were added in all the statements of the competence 2.2.1
- ✓ The word "existing" replaced the word "existed" in the first statement of competence 2.2.1
- ✓ The word "each" was added in the fourth statement of competence 2.2.1

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- ✓ One new statement was added in the competence 2.2.1 (*to combine existing STEAM/ Inclusive STEAM frameworks/ methods/ content/ learning objects/ tools/ apps/ software/ assessment tools and AT tools for achieving goals and objectives set for all learners in the previous steps*)
- ✓ The competence 2.2.3 was deleted and all its statements were added to competence 2.2.1
- ✓ Corrections were implemented on the statements of the competences 2.3.1 and 2.3.2
- ✓ The word "projects" was added in the first statement of competence 3.1.1
- ✓ The word "labs" was added in the last statement of competence 3.1.1
- ✓ The word "projects" was added in the last statement of competence 3.1.2
- ✓ The word "projects" was added in the second and the fifth statement of competence 3.1.3
- ✓ The word "seating" replaced the word "seats" in the third statement of competence 3.1.3
- ✓ The word "educational" was added in the names of competences 3.2.1 and 4.1.2
- ✓ The word "educational" was added in the first statement of competence 4.1.2
- ✓ The phrase "promote and support the" replaced the word "organize" in the first statement of competence 4.1.3
- ✓ Three new statements were added in competence 4.2.2 (*1) to articulate the benefits of inclusive STEAM education to a variety of stakeholders, including learners, educators, parents, and community members, 2) to communicate effectively with parents and other members of the educational community about the importance of inclusive STEAM education, and provide resources and support to help them engage with STEAM concepts and activities at home and 3) to collaborate with other educators and community members to promote and reinforce inclusive STEAM education awareness, such as by organizing community events, sharing resources, and participating in professional development opportunities*)

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- ✓ One new statement was added in the competence 5.1.1 (*to develop and apply creativity and innovation, critical thinking, adaptability skills, design thinking*)
- ✓ The phrase "*and sustainability principles even through the introduction of the Agenda 2030 and Sustainable Development goals*" was added in the last statement of competence 5.1.1
- ✓ One new statement was added in the competence 5.1.2 (*to develop and apply communication and collaboration skills*)
- ✓ The words "assess" and "projects" were added respectively to the first and the last statement of competence 5.2.1
- ✓ The initial statement of the competence 5.2.2 was deleted and three new statements were added for the better conceptualization of the competence (*1) to select and integrate appropriate digital tools based on the specific needs of their students and the learning objectives of their STEAM lessons, 2) to understand different digital tools and platforms that can be used for communication and collaboration in inclusive STEAM education, including video conferencing, collaborative document sharing, and project management tools and 3) to use digital tools to facilitate communication and collaboration among diverse groups of students*)
- ✓ The words "select and use" and "tools" were added in the name of the competence 5.3.1
- ✓ The word "projects" was added to the second statement of competence 5.3.1
- ✓ Two new statements were added to the competence 5.3.1 (*1) to select and use appropriate self- assessment tools for Inclusive and STEAM Education (e.g. STEAM SAT tool, SELFIE for Teachers, TEIP for Inclusive Education) and 2) to participate in educational organization self-assessment procedures (via proper tools or other evaluation procedures) for assessing educational organizations' general and technical equipment in the aspects of sufficiency and suitability for Inclusive STEAM Education procedure*) and
- ✓ The word "inclusion" was added in the name of the competence 5.3.2.

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Second asynchronous roundtable discussion and meeting

In the second asynchronous roundtable, the new version of the framework was uploaded on the collaborative online platform Basecamp, along with the changes that were made according to partners' comments and suggestions. Afterwards, all project partners were, then, requested to provide their comments on three questions, common for all, referred to the need of further changes on the competence framework, further comments and suggestions, as well as their satisfaction concerning the changes that had been made.

Partners had a time span of one week to provide their comments and after this, all their comments and suggestions were processed and included in the next final revised version of the framework. After the completion of such procedure, a meeting was implemented, as well, with a partner that had provided a significant number of additional comments for their further discussion. The changes that were made after the second asynchronous roundtable and the meeting, according to partners' suggestions, were the following:

- ✓ The competence 1.6.1 was deleted due to misunderstandings that could create in the conceptualization of Inclusion
- ✓ The competences 1.6.2-1.6.3 were moved at the top of the framework's order and their new positions were those of 1.1.1-1.1.3
- ✓ The word "audio" was added in the third statement of the new competence 1.1.2
- ✓ The second statement of the new competence 1.1.3 was rewritten in order to be more understandable
- ✓ The competence 1.1.2 of the framework's previous version was included in competence 1.2.1 (previous 1.1.1) along with its statements
- ✓ The phrases "and monitor" and "in Inclusive STEAM context" were added in the name of the new competence 1.2.1
- ✓ The first statement of competence 1.2.1 was rewritten in order to be more understandable
- ✓ The words "knowledge and" and "learners'" were added in the sixth statement of competence 1.2.1

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- ✓ The phrase "concerning STEAM education" was added in the seventh statement of competence 1.2.1
- ✓ The 9th, 10th, 11th and 13th statements of the competence 1.2.1 were rewritten, in order to be more understandable
- ✓ One more statement was added in competence 1.2.1 (*to monitor learners' needs in STEAM context*)
- ✓ The phrase "for Inclusive STEAM Education" was added in the name of the competence 1.2.2 (previous 1.1.3)
- ✓ The phrases "and identification" and "for Inclusive STEAM Education" were added in the first statement of the competence 1.2.2
- ✓ The word "each" and the phrase "abilities in Inclusive STEAM Education" were added in the last statement of the competence 1.2.2.
- ✓ The words "Educational procedure" were added in the name of the competence 1.3.1 (previous 1.2.1)
- ✓ Three new statements were added in the competence 1.3.1 (*1) to know, understand and apply the principles and techniques of constructivism theory of learning, 2) to identify learners' confusions, misinterpretations and misunderstandings of concepts under study through constructivism techniques (e.g., brainstorming, exploratory discussions, deductive approaches) and 3) to promote learners' conceptual change on concepts under study through constructivism techniques (e.g., cognitive conflicts)*)
- ✓ The third statement of the competence 1.3.1 was rewritten in order to be more understandable and examples were added for the same purpose (*e.g., brainstorming, exploratory discussions, deductive approaches*)
- ✓ The two last statements of the competence 1.3.1 were rewritten in order to be more understandable
- ✓ The first statement of the competence 1.3.2 (previous 1.2.2) was divided into two statements
- ✓ The words "educational frameworks" of the fifth statement of competence 1.3.2 were replaced with the words "teaching and learning techniques"
- ✓ The "Differentiation of Instruction (DI)" technique was added in the fifth statement of the competence 1.3.2

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- ✓ Two new statements were moved from another competence to competence 1.3.2 and the phrase "*to other educators/ special educators/ school staff/ headmasters/ learners' legal guardians*" was added to both statements for their specification
- ✓ The words "use and" were added to the second statement of the competence 1.4.1 (previous 1.3.1)
- ✓ The first statement of the competence 1.4.2 (previous 1.3.2) was rewritten in order to be more understandable
- ✓ The last statement of the competence 1.4.2 was rewritten in order to be more understandable and the phrase "*to other educators/ special educators/ school staff/ headmasters/ learners' legal guardians*" had been added for its specification
- ✓ The words "and analyze" were added to the names of the competences 1.5.1 and 1.5.2 (previous 1.4.1 and 1.4.2)
- ✓ The phrase "to all stakeholders" was added in the third statement of the competence 1.5.3 for its specification
- ✓ The word "parents" of the fourth statement of the competence 1.5.3 was replaced by the phrase "learners' legal guardians"
- ✓ The phrase "(possible) signs of disabilities" was added to the fourth statement of the competence 1.5.3
- ✓ The phrase "in Inclusive STEAM classrooms" was added to the name of the area 1.6 (previous 1.5)
- ✓ The word "learning" was added to the name of the competence 1.6.1 (previous 1.5.1)
- ✓ The word "robots" was added to the first statement of the competence 1.6.1
- ✓ The word "provide" of the second statement of the competence 1.6.2 was replaced by the word "use"
- ✓ One new statement was added in competence 1.6.2 (*to participate in educational organization procedures for providing appropriate for the learners' needs and each STEAM activity/ task Assistive Technology Tools*)
- ✓ The words "activities/ projects" was added to the name of the competence 1.6.2 (previous 1.5.2)

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- ✓ The verb "formulate" was replaced the verb "write down" in the third and the seventh statement of competence 2.1.1
- ✓ Plural was used for the words "course" and "lesson" in the name of the competence 2.1.2
- ✓ The verb "formulate" was replaced the verb "write down" in the first, third and eighth statement of competence 2.1.2
- ✓ The first statement of the competence 2.3.1 was rewritten in order to be more understandable
- ✓ The first statement of the competence 2.3.2 was rewritten in order to be more understandable
- ✓ The third educators' role was rewritten in order to be more understandable
- ✓ The word "raising" was added in the name of the area 4.2 and
- ✓ The word "parents" in the second and third statement of the competence 4.2.2 was replaced with the words "learners' legal guardians"

After the two asynchronous roundtables and the meeting, the revised version of the competence framework could be seen in the Annex 2.

6. Validation the revised version of Inclusive STEAM Educators' Competence Framework

For the validation of the revised version of Inclusive STEAM Educators' Competence Framework developed from the previous phases of methodological procedure, a modified Delphi technique was implemented according to Fong, Ch'ng& Por (2013). The Delphi technique is a principal methodology to construct core competency models (Green, 2014), referring to multiple rounds of surveys with groups of participants who are usually geographically dispersed and it allows them to deal systematically with a complex problem or a task, until consensus is achieved. Those participants who form the Delphi panel should meet different criteria, with the major to be their commitment to involve in the research procedure (Adler & Ziglio, 1996).

6.1. Formation of the Delphi panel

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For the current methodological procedure, the criterion set for selecting the Delphi panel was the proper representation of the target groups from the four countries participating in the project SpicE. For this reason, project partners from the four participating countries were requested to suggest five participants per country who would commit to be involved in the research procedure and belong to one of the above categories:

- ✓ Category of general primary education teacher
- ✓ Category of general primary education headmaster
- ✓ Category of special primary education teacher
- ✓ Category of general primary education headmaster
- ✓ Category of pre-service primary teachers

Partners had almost a week in order to provide the names and the e-mails of the participants, as the next steps of the methodological procedure would be implemented through this route.

6.2. First round of Delphi technique

After the formation of the Delphi panel, every participant was contacted via e-mail. The panelists were given brief explanations regarding the Competence Framework, the research objectives and the expectations from them. In addition they were given the revised version of the Inclusive STEAM Educators' Competence Framework, in order to be informed, and a survey concerning its components.

In such survey, which was the questionnaire for Round 1, each educator' s role in the framework was presented separately, followed by four questions concerning the clarity, the sufficiency, the significance and the placement of the competences within the provided role. Furthermore, the question of further comments or suggestions was given to them for each role and the framework as a whole. The participants of the Delphi panel had a time-span of two weeks, in order to send their answers, with reminders to be sent to them one week, two days and one day before the due date. The duration, nevertheless, of the first round was extended for another week, in order that few remaining responses would be collected. In this direction, project partners

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had contributed mainly to the completion of the procedure, reaching the panelists that had not provided answers, in order to remind them about the procedure.

After the collection of all answers, all participants were informed that their comments would be taken into concern for the formation of the next framework's version that would be sent to them in the next days for further comments and suggestions. The changes that were made in such round, according to their suggestions were the following:

- ✓ A short description was added above the Competence Areas and the examples of competences' statements, for their better conceptualization and understanding
- ✓ The phrase "and apply" was added in the names of the competences 1.1.1 and 1.1.2
- ✓ Three new statements were added in the competence 1.1.1 (*1) to describe important characteristics of Instructional means for Special Education, such as the Individualized Lesson Plan (ILP), 2) to demonstrate knowledge of the great value and necessity of those frameworks and techniques and 3) to apply knowledge of Inclusive and Special education in everyday school practice*)
- ✓ Three new statements were added in the competence 1.1.2 (*1) to report the dynamic interaction of all fields of STEAM Education, 2) to recognize the collaborative and group dynamic techniques needed for the success of STEAM Education and 3) to apply knowledge of STEAM education in everyday school practice)*
- ✓ The name of the competence 1.1.3 was rewritten in order to be more understandable (*Identify and examine the impact of STEAM Education in Inclusive Educational Environments*)
- ✓ The statements of the competence 1.1.3 were rewritten in order to be more understandable (*1) to be aware of the impact of STEAM education practices in the inclusion of all learners (with or without disabilities, minorities, learners with different socioeconomic and cultural background), 2) to recognize and examine the necessity of STEAM Education in the development of all learners' needed knowledge and skills as defined from future societies and*

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labour markets and 3) to identify the added value of STEAM approach in the creation of educational scenarios for all learners whose aims could not be achieved through traditional teaching method

- ✓ The word "examine" was added in the last statement of the competence 1.1.3
- ✓ The name of the area 1.3 was rewritten in order to be more understandable (*teaching methods and practices in Inclusive STEAM classrooms*)
- ✓ Examples were added to the last statement of the competence 1.3.1 (*e.g. problem-solving, critical thinking, decision making, skills from STEAM disciplines*) for its better conceptualization
- ✓ The technique "research based learning" was added in the first statement of the competence 1.3.2
- ✓ The phrases "Special Education" and "Individualized Lesson plans (ILP)" were added in the fifth statement of competence 1.3.2
- ✓ The words "Special Education" and "ILP" were added in the sixth statement of the competence 1.3.2
- ✓ The word "methods" was added in the name of the competence 1.3.3
- ✓ The word "methods" was added in the first statement of the competence 1.3.3
- ✓ The name of the competence 1.4.1 was rewritten in order to be more understandable (*Use appropriate resources and (Assistive Technology) tools according to learners' needs and profiles in Inclusive STEAM activities and projects*)
- ✓ The first two statements of the competence 1.6.1 were moved to the competence 1.4.1
- ✓ The name of the competence 1.4.2 was rewritten in order to be more understandable (*Provide appropriate Instructions according to learners' needs and profiles in Inclusive STEAM activities and projects*)
- ✓ The phrase "according to learners' ability as assessed from learners' profiling" was added in the fourth statement of the competence 1.4.2
- ✓ The phrase "and alternative ways" was added in the first statement of the competence 1.5.1
- ✓ One new statement was added in the competence 1.5.1 (*to collaborate with other general and special educators and staff participating in Inclusive STEAM activities/ projects in individual learners' assessment process*)

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- ✓ One new statement was added in the competence 1.5.2 (*to collaborate with other general and special educators and staff participating in Inclusive STEAM activities/ projects in group dynamics performance and interrelationships assessment*)
- ✓ The word "update" was added in the fourth statement of the competence 1.5.4
- ✓ One new statement was added in the competence 1.5.4 (*to collaborate with other general and special educators and staff participating in Inclusive STEAM activities/ projects in the development and updating of learners' portfolios*)
- ✓ The name of the competence 1.6.1 was rewritten in order to be more understandable (*Ensure accessibility and inclusion in Inclusive STEAM classrooms*)
- ✓ Four new statements were added in competence 1.6.1 (1) *to reassure access of all learners, including those with special needs, different cultural backgrounds and minorities to all the stages of educational procedure, 2) to address inclusion and diversity issues within the classroom during educational procedure, 3) to address prejudice and stereotypes in Inclusive STEAM educational procedure and 4) to raise disability awareness and promote multi-cultural and multi-ethnic understanding through Inclusive STEAM activities/ projects*)
- ✓ The word "resources" was added in the last statement of the competence 1.6.1
- ✓ Two new statements were added in the competence 1.6.2 (*1) to know, understand and be able to use techniques to enhance the interaction of learners and their active participation, providing appropriate guidance and assistance during STEAM activities and projects and 2) to provide guidance to learners in order to communicate with each other, and to suggest different points of view by developing an open learning environment for creative problem solving during STEAM activities and projects*)
- ✓ One new competence was added in the area 1.6 (*1.6.3. Promote learners' confidence and self-efficacy in Inclusive STEAM activities/ projects*)

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- ✓ Four new statements were added in the competence 1.6.3 (*1) to ensure an appropriate culture of learning in order to empower learners in Inclusive STEAM classrooms, 2) to provide opportunities to all learners to develop their skills and abilities in Inclusive STEAM activities/ projects, 3) to provide opportunities to all learners to share and use their talents in Inclusive STEAM activities/ projects and 4) to celebrate all learners' successes in Inclusive STEAM activities/ projects*)
- ✓ The phrase "and adapt" was added in the name of the competence 2.1.1
- ✓ The word "curricula" was replaced by the word "curriculum" in the name and the statements of competence 2.1.1
- ✓ The word "flexible" was added in the fifth statement of the competence 2.1.1
- ✓ The words "and goals" were added twice in the last statement of the competence 2.1.1
- ✓ The phrase "and adapt" was added in the name of the competences 2.1.2 and 2.1.3
- ✓ One new statement was added in the competence 2.1.3 (*to adapt the designed Inclusive STEAM activities to the society's and labour market's needs*)
- ✓ The name of the competence 2.2.1 was rewritten in order to be in accordance with the statements of the competence (*Identify and select appropriate resources and (Assistive Technology) tools for Inclusive STEAM Education*)
- ✓ The phrase "and adapt" was added in the name of the competence 2.2.2
- ✓ The word "instructions" was added in the third statement of the competence 2.2.2
- ✓ The word "all" was added in the name of the competences 2.3.1 and 2.3.2
- ✓ The word "managing" was added in the third role of Inclusive STEAM educator
- ✓ The name of the competence 3.1.1 was rewritten in order to be more understandable (*Apply spatial and physical organization methods in inclusive STEAM Classrooms*)
- ✓ The word "projects" was added in the last statement of the competence 3.1.2

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- ✓ The name of the competence 3.1.3 was rewritten in order to be more understandable (*Apply time management and learning organization methods for Inclusive STEAM activities and projects*)
- ✓ Two new statements were added in the competence 3.1.3 (*1) to assume the role of facilitator during the Inclusive STEAM educational process and 2) to respect learners' pace, providing extra or less time for the completion of lesson's activities and projects*
- ✓ The phrase "(Individualized) Inclusive STEAM" was added in the last statement of the competence 3.1.3
- ✓ The phrase "and projects" was added in the name of the competence 3.2.1
- ✓ Four new statements were added in the competence 3.2.1 (*1) to monitor learners' challenging behaviours, 2) to help learners to recognize, self-assess and appropriately manage their behaviours and emotions, 3) to facilitate the formation of groups of learners of varying ability levels during the implementation of Inclusive STEAM educational activities and projects and 4) to promote mutual help strategies within the Inclusive STEAM classrooms that are beneficial to all learners*)
- ✓ The phrases "national and international" and "teaching methods" were added in the second statement of competence 4.1.1
- ✓ One new statement was added in the competence 4.1.1 (*to collaborate with educators from other educational institutions in order to promote Inclusive STEAM practices in schools)*
- ✓ One new statement was added in the competence 4.1.2 (*to establish meaningful connections and engage with industry professionals and businesses to bring real-world relevance to STEAM education, leveraging their expertise, resources, and experiences to enhance student learning and prepare them for future career pathways*)
- ✓ Examples were added in the last statement of competence 4.1.2 in order to be more understandable (*e.g. through collaborating research projects, sharing expertise and resources etc.*)
- ✓ The word "participate" replaced the word "engaged" in the first statement of competence 4.2.2

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- ✓ Examples were added in the first statement of competence 4.2.2 in order to be more understandable (*e.g. through comments, feedback and proposals on legislation and official policy documents*)
- ✓ A definition was added for the area 5.1 in order to be more understandable (*Transferable skills are skills learned in one context that are useful for another. They can serve as a bridge from study to work and from one career to another, as they enable subject and research-related skills to be applied and developed effectively in different work environments*)
- ✓ The words "resiliency and self-control skills" were added in the first statement of competence 5.1.1
- ✓ The name of the competence 5.2.1 was rewritten in order to be more understandable (Implement digital information and enhance data literacy skills)
- ✓ One new statement was added in the competence 5.2.1 (*to continuously grow digital knowledge and skills whereby one finds, evaluates, uses and shares information using digital tools*) and
- ✓ One new statement was added in the competence 5.3.2 (*to participate in various workshops, events, visit exhibitions etc. related to STEAM, Inclusion and Inclusive STEAM topics*).

6.3. Second round of Delphi technique

After the implementation of the above changes, every participant was contacted, again, via e-mail. In those e-mails, the panelists were given brief explanations regarding the expectations from them in this round. In addition, they were given the revised version of the Inclusive STEAM Educators' Competence Framework, with the changes in orange color in order to be easily accessible and a survey concerning its components.

In such survey, which was the questionnaire for Round 2, the framework was presented as a whole, and participants were asked:

- ✓ whether or not they felt satisfied about the changes

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- ✓ what was their opinion about framework's clarity, sufficiency and significance and
- ✓ if they had any other comment or suggestion

Delphi panel had a time-span of one week, in order to send their answers, with reminders to be sent to them two days and one day before the due date. The duration, nevertheless, of the second round was, also, extended for another week, in order that few remaining responses would be collected. In this direction, project partners had contributed, one more time, to the completion of the procedure, reaching the panelists that had not provided answers, in order to remind them about the procedure.

After the collection of all answers, almost all participants were given their consensus on the framework's structure and on the clarity, significance and efficiency of frameworks' components. Nevertheless, due to some clarity issues arisen from a small number of participants, further changes were made and the decision of the implementation of a third round of Delphi technique was taken, in order that consensus from all participants would be achieved. Concerning, the changes:

- ✓ the verb "understand" replaced the phrase "demonstrate knowledge" in the fourth statement of the competence 1.1.1
- ✓ the verb "understand" replaced the phrase "demonstrate knowledge" in the second statement of the competence 1.1.2
- ✓ the words "educational procedure" replaced the word "classrooms" in the name of the competence 1.6.1
- ✓ the first statement of the competence 1.6.2 was rewritten in order to be more understandable (*to know, understand and be able to use techniques to enhance the active participation of learners as well as the interaction between them by providing appropriate guidance and assistance during STEAM activities and projects)*
- ✓ one example was added in the last statement of the competence 2.1.3 in order to be more understandable (*e.g. by incorporating coding and technology skills relevant to the digital job market*) and

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- ✓ the name of the competence 5.2.1 was rewritten in order to be more understandable (*Develop and apply digital information and data literacy skills*).

6.4. Third round of Delphi technique

Finally, in the third round of Delphi technique, participants were informed via email for the framework's latest version and the changes that had been implemented after the end of the previous round, on framework's statements and competences. Afterwards they were asked to answer within one week whether they agreed or not with the changes and the framework's latest version. In such round their consensus was important, in order that the validation procedure could be closed.

All participants of Delphi panel were given their consensus, leading to the end of the framework's validation procedure. Then the final framework's version had been uploaded on the project partners' collaborative online platform "Basecamp", along with a small description of the rounds of the Delphi technique, in order that they would be informed.

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7. The Inclusive STEAM Educators' Competence Framework

The final Inclusive STEAM Educators' Competence Framework developed through all the previous methodological steps consists, starting from its highest level to the lowest levels, of:

- Perspectives which represent the different roles that educators have in the Inclusive STEAM educational context.
- Competence areas which represent the different dimensions of educators' roles within the Inclusive STEAM educational context
- Competences which represent educators' ability to use knowledge, skills and personal, social and/or methodological abilities in work or study situations and professional and personal development, describing "**what educators should be able to do**" and
- Examples of Competences' statements.

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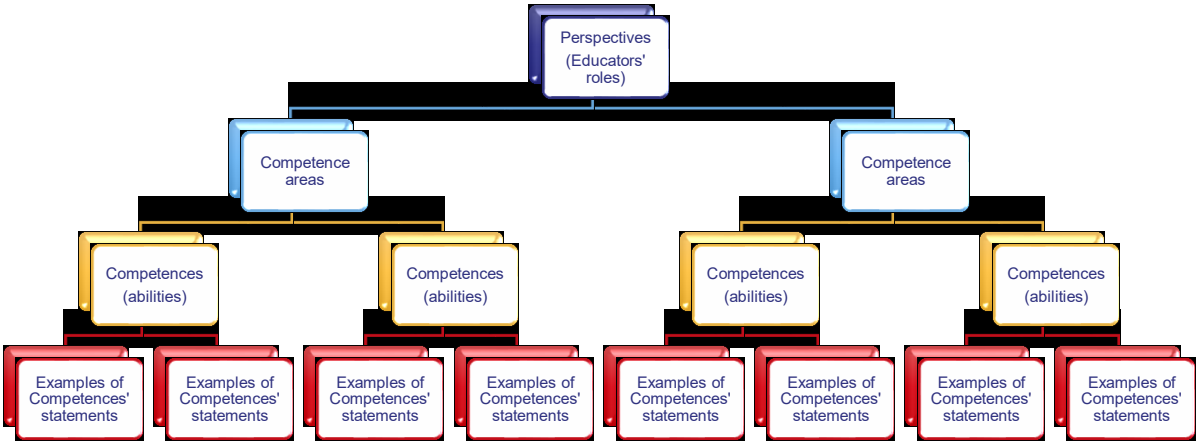

Figure 4: Structure of inclusive STEAM Educators' Competence Framework

The Framework has five different perspectives-roles, which are those of:

- Educator as an Inclusive STEAM teacher- trainer- tutor, which includes all the required educators' competences during the implementation of an Inclusive STEAM educational procedure
- Educator as an Inclusive STEAM Education designer and creator, which includes all the required educators' competences related to designing and creating Inclusive STEAM educational opportunities
- Educator as an Inclusive STEAM Education orchestrator, which includes all the required educators' competences related to coordinating and managing Inclusive STEAM procedures, resources and classrooms' members
- Educator as a community member, which includes all the required educators' competences related to interacting and engaging with different Inclusive/ STEAM/ Inclusive STEAM communities and applying policies and
- Educator as a growing Inclusive STEAM professional, which includes all the required educators' competences related to their continuous professional

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development and (self) assessment along with the transferable and digital skills needed during Inclusive STEAM activities.

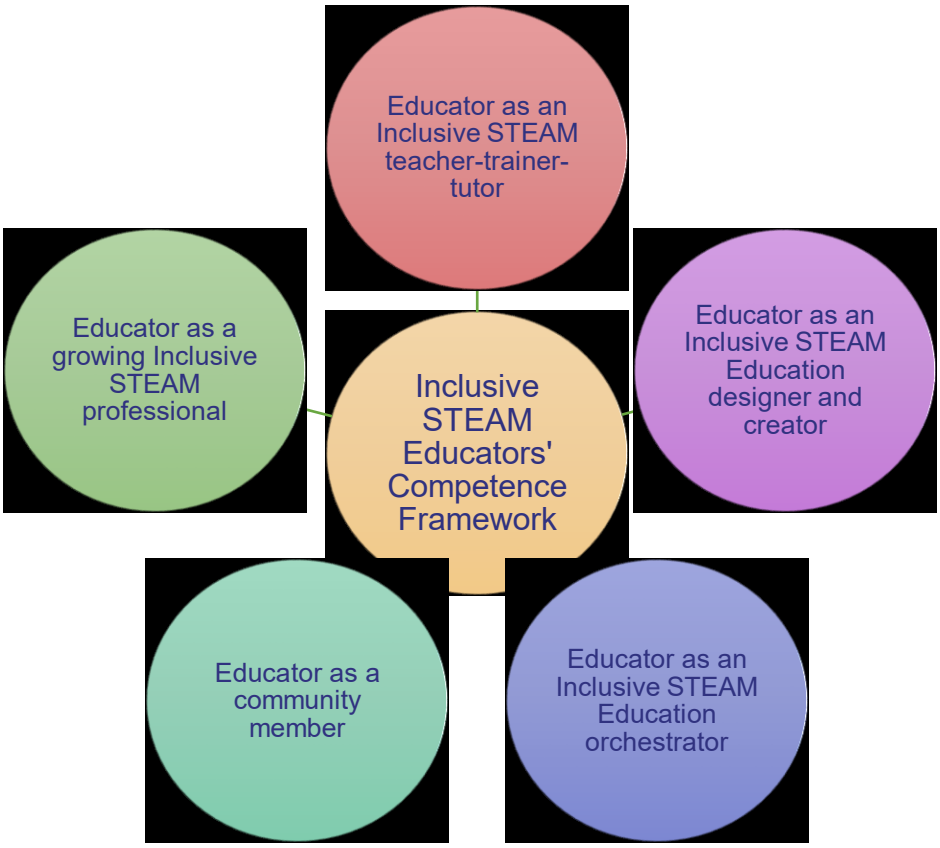

Figure 5: Educators' roles within the Inclusive STEAM Educators' Competence Framework

Table 6 presents the validated form of Inclusive STEAM Educators' Competence Framework

Table 6: Validated Inclusive STEAM Educators' Competence Framework

Competence Areas **(Areas within roles in which Inclusive STEAM Educators should possess competences)**	**Competences**
1. Educator as an Inclusive STEAM teacher- trainer-tutor/ implementing the Inclusive STEAM educational procedure	

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1.1. Inclusive STEAM Education foundations	*1.1.1. Demonstrate and apply knowledge of Inclusive and Special Education*
	1.1.2. Demonstrate and apply knowledge of the STEAM education approach
	1.1.3. Identify and examine the impact of STEAM Education in Inclusive Educational Environments
1.2.Learners' profiling in Inclusive STEAM classrooms	*1.2.1. Assess, analyze and monitor learners' needs in Inclusive STEAM context*
	1.2.2. Develop learners' profiles for Inclusive STEAM Education
1.3. Teaching methods and practices in Inclusive STEAM classrooms	*1.3.1. Integrate learners' prior knowledge and skills in Inclusive STEAM Educational procedure*
	1.3.2. Apply Inclusive STEAM teaching and learning techniques in Inclusive STEAM classrooms
	1.3.3. Apply teamwork methods and group dynamic methods for collaborative learning educational activities in Inclusive STEAM classrooms
1.4. Inclusive STEAM resources and instructions	*1.4.1. Use appropriate resources and (Assistive Technology) tools according to learners' needs and profiles in Inclusive STEAM activities and projects*
	1.4.2. Provide appropriate instructions according to learners' needs and profiles in Inclusive STEAM activities and projects
1.5. Assessment and feedback in Inclusive STEAM classrooms	*1.5.1. Assess and analyze individual learners' activity/ project performance in Inclusive STEAM classrooms*
	1.5.2. Assess and analyze group dynamics and interrelationships in Inclusive STEAM classrooms
	1.5.3. Provide appropriate feedback to all stakeholders
	1.5.4. Develop learners' STEAM portfolios
1.6. Learners'	*1.6.1. Ensure accessibility and inclusion in Inclusive STEAM educational*

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empowerment in Inclusive STEAM classrooms	*procedures*
	1.6.2. Ensure all learners' active engagement in Inclusive STEAM activities/ projects
	1.6.3. Promote learners' confidence and self-efficacy in Inclusive STEAM activities/ projects
2. Educator as an Inclusive STEAM Education designer and creator/ designing and creating Inclusive STEAM opportunities	
2.1. Educational Design for Inclusive STEAM Education	*2.1.1. Design and adapt Inclusive STEAM Education curriculum of STEAM-related general and special education disciplines*
	2.1.2. Design and adapt Inclusive STEAM education courses/ lessons
	2.1.3. Design and adapt Inclusive STEAM educational activities and projects
2.2. Educational Design for Inclusive STEAM resources and instruction	*2.2.1. Identify and select appropriate resources and (Assistive Technology) tools for Inclusive STEAM Education*
	2.2.2. Design, create and adapt appropriate resources and instructions for Inclusive STEAM Education
2.3. Learners' development	*2.3.1. Facilitate learners' STEAM competences*
	2.3.2. Facilitate learners' Inclusive competences
3. Educator as an Inclusive STEAM Education orchestrator / coordinating and managing Inclusive STEAM procedures, resources and classroom's members	
3.1. Inclusive STEAM educational procedures and resources coordination	*3.1.1. Apply* spatial and physical organization *methods in Inclusive STEAM Classrooms*
	3.1.2. Apply educational resources' management methods in Inclusive STEAM Education activities and projects
	3.1.3. Apply time management and learning organization methods for Inclusive STEAM activities and projects
3.2. Inclusive STEAM classroom's members	*3.2.1. Coordinate learners and groups of learners during Inclusive STEAM educational activities and projects*

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coordination	*3.2.2. Coordinate team of educators and special education staff during a collaborative Inclusive STEAM teaching procedure*
4. Educator as a community member/ interacting with the environment	
4.1. Community building	*4.1.1. Participate and collaborate in local, national, and international educational communities, including schools and educators*
	4.1.2. Engage with industry professionals and businesses
	4.1.3. Participate and collaborate in community organizations and institutions
4.2. Application of policies and community awareness raising	*4.2.1. Implement policies that promote STEAM Education and Inclusion*
	4.2.2. Raise Inclusive STEAM education awareness in the educational community
5. Educator as a growing Inclusive STEAM professional/ developing and applying competences	
5.1. Transferable skills[2]	*5.1.1. Develop and apply personal transferable skills*
	5.1.2. Develop and apply social transferable skills
	5.1.3. Develop and apply learning to learn transferable skills
5.2. Digital skills	*5.2.1. Develop and apply digital information and data literacy skills*
	5.2.2. Manage and use digital tools for communication and collaboration in Inclusive STEAM education
5.3. (Self) reflective and lifelong learning skills	*5.3.1. Select and use (self)reflective practices and tools for Inclusive STEAM Education*

[2] *Transferable skills are skills learned in one context that are useful for another. They can serve as a bridge from study to work and from one career to another, as they enable subject and research-related skills to be applied and developed effectively in different work environments.*

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	5.3.2. Participate in lifelong learning related to STEAM, Inclusion, and Inclusive STEAM educational approach
	5.3.3. Apply action research procedures for reflection and improvement of educational procedures in Inclusive STEAM Education

The Inclusive STEAM Educators' Competence Framework consists of sixteen (16) competence areas, forty-two (42) competences and various competences statements. The detailed version of the framework could be seen in the Annex 3.

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8. The Inclusive STEAM Educators' job profiles based on ESCO

8.1. Introduction to ESCO classification

ESCO is the European classification of Skills, Competences, qualifications and Occupations, aiming to provide a common reference terminology in the European labor market, in order to be more effective and integrated (European Commission, 2023a). ESCO classification acts as a dictionary, describing, identifying and classifying professional occupations, along with their skills, competences and knowledge and showing systematically the relations between those occupations and descriptive elements (European Commission, 2023a). It is available in 27 languages (24 EU languages and Icelandic, Norwegian and Arabic) and it can be consulted and downloaded free of charge.

ESCO, through it shared terminology, could assist:

- jobseekers to document and describe their knowledge, skills and competences in order to match job openings more accurately
- education and training institutions to:
  - use a multilingual reference terminology to describe the learning outcomes and their qualifications, making the qualifications more transparent
  - adapt their programmes based on feedback from the labor market and
  - work more closely with employment services and career advisors
- employers to precisely state their skills and qualifications they expect from employees
- online job search websites (like Europe-wide recruitment databases) to match people with jobs in EU countries, even when CVs and job vacancies are in different languages and
- employment services and career advisors to build partnerships and share data (European Commission, 2023a)

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It is a live entity that is undergoing a constant process of updating and enriching (Chiarello, Fantoni, Hogarth, Giordano, Blatina, & Spada, 2021), with its new version (v1.1) to have been released in January 2022, after a close collaboration with sectoral experts and ESCO stakeholders (European Commission, 2020). In the new release of ESCO, two main pillars could be identified: the occupation pillar and the skills pillar. The occupation pillar organizes the occupation concepts in ESCO, using hierarchical relationships between them, metadata and mappings to the International Standard Classification of Occupations, in order to structure them (European Commission, 2023b). On the other hand, the skills pillar distinguishes between i) skills/ competences concepts and ii) knowledge concepts by indicating the skills type, with every concept to include an explanation in the form of description and no distinction to occur between skills and competences (European Commission, 2023b).

8.2. The ESCO occupational profiles

The occupational profiles in ESCO are described through an initial text field providing a short explanation of the meaning of the occupation and how it should be understood and distinguished from other occupations. They, also, provide a list of specialists considered within the scope of occupation and the hierarchical relationships between every occupation with others.

In addition, occupational profiles provide essential and optional knowledge, skills and competence concepts, in which:

- ✓ Essential are those knowledge, skills, and competences usually relevant for an occupation, independent of the work context, employer, or country and
- ✓ Optional are those knowledge, skills and competences that may be relevant or occur when working in an occupation depending on the employer, work context or country. Optional knowledge, skills and competences are very important for job matching because they reflect the diversity of jobs within the same occupation.

Those knowledge, skills and competences concepts had been considered by experts as relevant for the described occupation on a European scale (European Commission, 2023c).

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8.3.The need

In ESCO taxonomy, there is a great variety of well defined occupational profiles concerning the general and special education primary school teachers, with such profiles to have knowledge, skills and competences concepts linked either directly or indirectly to Inclusion and STEAM-related disciplines. More specifically, and comparing the two basic profiles of general (code 2341.1)[3] and special educational needs primary school teacher (code 2352.1.5)[4], it is obvious that there are both essential and optional knowledge, skills and competences, in the first profile, referring to Inclusion through the integration of multicultural and special needs education parameters. Moreover, it is worth saying that the second profile of special educational needs teacher is characterized by ESCO, alternatively, as an Inclusive educator profile, with the provided description, nevertheless, to have to be further investigated about its alignment with such role.

In addition and concerning those two profiles and STEAM Education, there is an obvious representation of STEAM- related disciplines in the essential and optional knowledge, skills and competences concepts of the general primary teacher profile, with an obvious, nevertheless, lack of representation of the transdisciplinary/ interdisciplinary approach needed for the implementation of STEAM education. The latter is absent on the special educational needs primary teacher profile as well, along with the complete absence of representation of STEAM-related disciplines and educational approaches. Consequently and from all the above, a first indicator concerning the lack of representation of Inclusive STEAM primary educator occupational profiles in ESCO taxonomy has been identified for further investigation.

[3] http://data.europa.eu/esco/occupation/03d79393-7b30-4159-945b-01963eddd302
[4] http://data.europa.eu/esco/occupation/f89b12a1-689f-4a4f-8695-abb620810f1e

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This was, also, apparent on the two additional special education staff profiles, such as a) the learning support teacher (code 2352.1.3)[5] and b) the teacher of talented and gifted students (code 2352.2)[6] that have been identified on ESCO taxonomy, focusing on specific student populations. In the descriptions of such profiles, there is a lack of both Inclusive and STEAM education parameters, factor that supports the need of further investigation of their suitability in the Inclusive STEAM Education primary school context. In addition, and because of the variety of occupational profiles identified in ESCO taxonomy concerning diverse groups of student population, another need had arisen and was that of the investigation of the number and type of professions required for the proper implementation of Inclusive STEAM Education in primary school context.

The SpicE project has come to shed light to such questions, in order that the appropriate occupational profiles would be developed.

8.4. Methodology

In order to identify the job profiles for Inclusive STEAM Educators, the Competence Framework for Inclusive STEAM educators was exploited. Then, we followed the same methodology that was used for the development of Competence Framework for Inclusive STEAM Educators with little modifications as the following image describes.

[5] http://data.europa.eu/esco/occupation/114c5a6c-1869-4a67-8ec0-660ec303f8cc
[6] http://data.europa.eu/esco/occupation/1044dedc-81d1-48b6-96b3-ced5393b2de1

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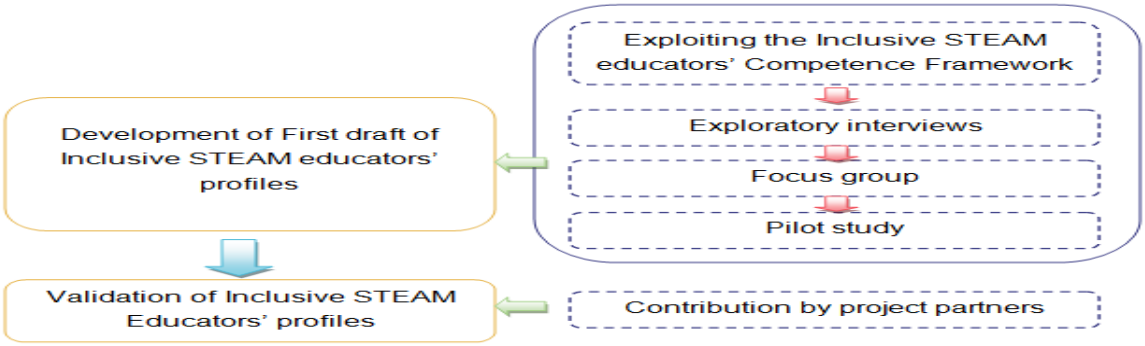

Figure 6: Methodology for the development of Inclusive STEAM primary educators' occupational profiles

Those steps were distributed in a time span of almost one month, due to delays from the validation procedure of the Competence Framework. The involvement of the community was, once again, of high priority in almost all the stages of the procedure, whereas the contribution of project partners was vital for the completion of the procedure. The results from each of the above steps of the methodology would be described in detail in the following sectors.

8.4.1. Exploiting the Inclusive STEAM educators' Competence Framework

Consequently and starting from the first step of the methodology, the Inclusive STEAM educators' competence framework was exploited in the aspects of the representation of its competences in the already existing occupational profiles proposed by ESCO. From such analysis, it was revealed that a significant number of the framework's competences had not been represented through the already existing profiles, factor that indicated the need of the development of new profiles. For the identification of such profiles, the profiles from STEAMonedu Erasmus+ project were taken as a foundation (Spyropoulou & Kameas, 2023; Spyropoulou & Kameas, 2021b), whereas an analysis of educators' collaborative needs was implemented, concerning the implementation of Inclusive STEAM Education, Inclusive Education and STEAM Education.

For the first parameter, our project SpicE T2.1 report (University of Macedonia, 2023), along with the report of Erasmus+ project Steam4SEN (2019) and Milanovic et al. (2023) paper was mainly analyzed in such direction. From the above analysis,

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three profiles were identified and were those of (Inclusive STEAM) general teacher, Inclusive STEAM pedagogy expert and STEAM special needs teacher (for Inclusive Education).

Afterwards, the occupational profiles identified in the previous step along with the additional occupational profiles for Special Education from ESCO taxonomy were further investigated in the aspects of their necessity in either Inclusive or STEAM educational contexts through literature review. In this step, the papers of Paulsrud & Nilholm (2023), Bhroin & King (2020), Nilsen (2020), Mulhollan & O'Connor (2016) and Leatherman(2009) were analyzed in the aspect of Inclusive education, whereas the papers of, Li, Luo, Zhao, Zhu, Ma & Liao (2022) and Boice, Jackson, Alemdar, Rao, Grossman & Usselman (2021) were analyzed in the aspect of STEAM Education. From the above analysis, a variety of needed occupational profiles were identified for either Inclusion or STEAM, with the researches to highlight the roles of classroom teachers, special education needs teachers, learning support teachers and instructional assistants for the first, and STEAM pedagogical and content experts and teachers from STEAM- related disciplined for the latter.

8.4.2. Exploratory interviews

In order that the need of the previously referred roles would be further identified, exploratory interviews were implemented among two pre-service (general and special education) primary teachers and four in-service (two general and two special education) primary teachers. The participants were selected with the use of the convenience sampling technique due to the limited time span for the conduction of the exploratory procedure.

The participants on the study were asked to answer the following questions:

1. How easy, according to their opinion and experience, is the implementation of Inclusive STEAM education
2. If, according to their opinion, the Inclusive STEAM educational procedure could be successfully implemented by only the classroom teacher or not and to explain the reasons why and

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3. What, according to their opinion, are the teachers' occupational profiles needed for the proper implementation of Inclusive STEAM Education

As a result of such procedure, and concerning the first question:

- ☑ all participants stated that the Inclusive STEAM Education is a complex task to be accomplished

Concerning the second question:

- ☑ all participants agreed that Inclusive STEAM Education could not be successfully implemented by only one teacher and that it should be a collaborative task
- ☑ all participants presented self-efficacy concerns about STEAM education, stating, mostly, that the integration of various disciplines along with the presence of students with disabilities could create a lot of challenges in the educational procedure
- ☑ the in-service primary teachers presented self- efficacy concerns about special education issues, factor that could interfere, according to their opinion with the successful implementation of Inclusion and
- ☑ the two special education teachers along with the two pre-service teachers, agreed that although Inclusive STEAM education should be a collaborative task, nevertheless, they had concerns about the nature and implementation of such collaboration.

Finally and concerning the last question:

- ☑ all participants underlined the need of special educators
- ☑ all participants except one general in-service teacher underlined the need of different affiliations of paraprofessionals as parallel support teachers, especially for students with more profound difficulties
- ☑ the two general in-service teachers, along with the one pre-service special education teacher underlined the need of a mentor that would have expertise in Inclusive and STEAM education and

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- ☑ almost all the participants except for one general in-service teacher underlined the need of collaboration among other educators with different specialties (Art teacher, Music teacher and Computer teacher).

From all the above, it became obvious that the professions proposed by the participants were in accordance with the results derived from the literature review and stronger indicators were derived about the profiles that would be further examined in the next step.

8.4.3. Focus group

Consequently, for the next step of the methodology, the three profiles identified in ESCO taxonomy (2023b) concerning the general primary school teacher, the special educational needs primary school teacher and the learning support teacher, along with the profile of STEAM pedagogy expert developed from Erasmus+ STEAMonedu project (Spyropoulou & Kameas, 2021b) were further examined in the aspects of their significance and efficiency in Inclusive STEAM settings. For such investigation, a focus group study was implemented among three in-service general education teachers, three in-service special education teachers and two headmasters (one in general education and one in special education). The participants were selected with the use of the convenience sampling technique due to the limited time span, with a selection criterion of more than five years of didactic experience in both settings.

The participants were, firstly, introduced to the notion and functionality of ESCO taxonomy (2023b), and then asked to study the descriptions of the occupational profiles described above from both ESCO (2023b) and STEAMonedu project (Spyropoulou & Kameas, 2021b). Afterwards, a discussion took place among the participants concerning the following questions:

1. If, according to their opinion and experience, four professionals (primary school teacher, special educational needs primary school teacher, learning support teacher and STEAM pedagogy expert) are sufficient for the successful implementation of Inclusive STEAM Education or not and if not, what are their other suggestions

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2. If, according to their opinion and experience the existing profiles proposed by ESCO are sufficient for Inclusive STEAM settings
3. If, according to their opinion and experience, the existing profiles proposed by ESCO and STEAMonedu should be renamed in order to be compatible with the Inclusive and STEAM parameter of Inclusive STEAM Education and
4. If the previous answer is positive, what, according to their opinion, is the position of those profiles in ESCO taxonomy.

As a result of the procedure, all participants confirmed the necessity of the proposed profiles, underlying their efficiency for the proper implementation of the Inclusive STEAM procedure. Moreover, they mentioned the absence of Inclusive and STEAM parameters in all the ESCO profiles, stating that the complexity of such a procedure requires, according to their opinion, a more analytical job description acting as a self-assessment tool as well for educators. In addition, and concerning the third question, they all agreed that Inclusive and STEAM parameters should be included in the names of the existing profiles in order to reflect the profession that would be described and to be in accordance with the actual occupational profiles needed for the Inclusive STEAM Educational context. Thus, a further discussion occurred on the names of the profiles and the group concluded the names of:

- ✓ Inclusive STEAM primary education teacher
- ✓ STEAM Special education needs primary school teacher
- ✓ Inclusive STEAM learning support teacher and
- ✓ Inclusive STEAM pedagogy expert

Finally, and concerning the last question, a broader discussion was conducted due to its complexity. More specifically, the participants had concerns about the exact position of those occupations in ESCO taxonomy, as according to them neither the general education category nor the special education category could reflect the Inclusive dimension. In addition, according to their opinion, those educators should have specific roles in Inclusive STEAM context and due to the innovation of both educational approaches the significance of such roles should be further highlighted. For this reason, they agreed on the placement of all the four profiles in a new group of educators that would highlight and present their roles in detail.

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8.4.4. Pilot study

The placement of those profiles in a new group of educators in ESCO taxonomy meant, nevertheless, that the four proposed profiles would be new profiles with their components to be derived, according to ESCO, from the Competence Framework for Inclusive STEAM Educators, developed in the previous step. In order that the competences of the framework would be aligned with the four new profiles, a pilot study was implemented in a diverse sample of teachers and special education staff. The sample was selected through the convenience sampling technique, whereas an effort was made in order that a high representation of all the four teaching professions would be achieved. As a result, nine (9) teachers participated in the survey of the current step (one in-service general primary teacher (with experience in both general and special education), one in-service special primary teacher (with experience in both general and special education), one pre-service general primary teacher, one pre-service special primary teacher, one art teacher (with experience in both general and special education), one computer teacher (with experience in both general and special education),one school nurse, one learning assistant teacher and one speech therapy teacher).

Those participants were informed at the beginning of the survey about the ESCO taxonomy and the definitions of essential and optional skills for every occupational profile, whereas, afterwards they were asked to categorize each competence of Inclusive STEAM Competence Framework into essential, optional and irrelevant categories for each profile. Afterwards, they were asked if they believed that those four profiles are sufficient for the successful implementation of Inclusive STEAM Education and if they had additional comments and suggestions about those profiles. In addition, supplementary questions were given for each category and more specifically:

- ✓ the Art teacher and the Computer teacher were additionally asked whether the profiles of Inclusive STEAM primary teacher and STEAM special education needs primary teacher were suitable for their profession and

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- ✓ the school nurse and the speech therapy teacher were additionally asked whether the profile of Inclusive STEAM learning assistant was suitable for their profession.

As a result of such procedure, the significance of the four proposed profiles was also underlined and highlighted, whereas the suitability of the three first profiles with the various professions was also revealed. Finally, the results from participants' categorization of competences led to the formation of the profiles and the completion of essential and optional competences fields, with the fields of essential and optional knowledge of the profiles being derived from the body of associated competences. Finally, the proposed code and the description of each profile were written.

8.5 Validation of Inclusive STEAM primary educators' occupational profiles

In order that the Inclusive STEAM primary educators' occupational profiles would be validated, significant was the contribution of all project partners from teachers' associations (MOESY, OUHS, RDEWG, STEPV, TUT). Thus, and despite the fact that only two project partners had to be involved in such procedure, the consortium agreed on the contribution of other three partners, in order that all countries would be represented.

For such validation, the profiles developed from the previous steps were uploaded on the collaborative online platform "Basecamp", along with the survey questions concerning their components and the proposed profiles as a whole. The project partners from teachers' associations (MOESY, OUHS, RDEWG, STEPV, TUT) were, then, requested to provide their comments on fifteen questions, three concerning all profiles and the others referring to each profile separately. More specifically, project partners were asked to answer, concerning each profile:

- ✓ whether or not, according to their opinion and experience, should any competence be moved from the essential to optional category and vice versa, explaining the reasons of that change

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- ✓ whether or not, according to their opinion and experience, should any competence be deleted as irrelevant to the describing role, explaining the reasons for that removal and
- ✓ if, according to their opinion and experience, they had any other additional comment or suggestion concerning the profile.

In addition, and concerning all the profiles as a whole, project partners were requested to answer:

- ✓ If, according to their opinion and experience, the four profiles proposed could be applicable in Inclusive STEAM educational environments
- ✓ If, according to their opinion and experience, the four profiles proposed are needed for the successful implementation of Inclusive STEAM educational procedure and
- ✓ if, according to their opinion and experience, they had any other additional comment or suggestion concerning the profile.

The feedback and suggestions from project partners were carefully reviewed and incorporated to ensure the development of updated profiles. After the end of the procedure, all partners' answers were taken into consideration for the development of the final version of the profiles. In particular, minor adjustments were suggested for the distribution of competences within each profile in response to the first set of questions. Regarding the second set of questions, all partners emphasized the practicality and importance of the proposed profiles in facilitating the successful implementation of the Inclusive STEAM Educational procedure.

9. The Inclusive STEAM primary educators' occupational profiles

The final Inclusive STEAM primary educators' occupational profiles, developed through all the previous methodological steps were:

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1. Inclusive STEAM primary school teacher
2. STEAM special educational needs primary school teacher
3. Inclusive STEAM learning support teacher and
4. Inclusive STEAM pedagogy expert.

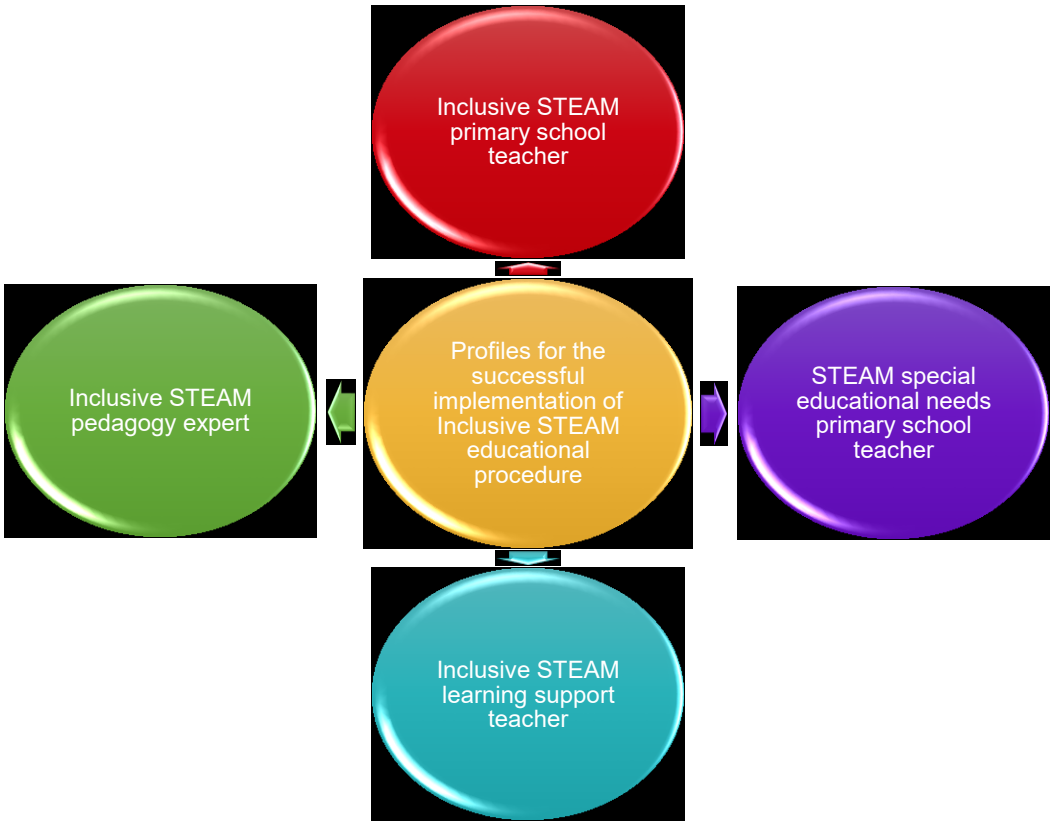

Figure 7: The primary educators' occupational profiles needed for the successful implementation of Inclusive STEAM educational procedure

Those profiles were proposed to be classified in a new category of Inclusive STEAM educators in primary schools, with a proposed new code 2343 in ESCO classification, due to the complexity and the innovation of the two pedagogical approaches. Such code would be further proposed to ESCO. The sections below provide those profiles.

9.1. The Inclusive STEAM primary school teacher occupational profile

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Name	**Inclusive STEAM primary school teacher**
Code	2343.1
Description	Inclusive STEAM teachers at primary schools educate students using approaches that reflect the STEAM and Inclusive Education philosophy and principles. They focus on inclusive teaching approaches that use Science, Technology, Engineering, the Arts and Mathematics as access points for guiding all students' inquiry, dialogue and critical thinking, facilitating the development of all students' needed competences as defined by labor markets and future societies. Inclusive STEAM teachers in primary schools design Inclusive STEAM curriculums and lesson plans in line with STEAM related disciplines curriculum objectives and inclusive goals and instruct students in an accessible, for all, learning environment that respects and engages diversity and encourages them to participate, collaborate and solve problems. They monitor all students' learning development and evaluate their knowledge and skills on the subjects taught, building, in addition, their courses content on the students' prior knowledge and skills. They use appropriate resources, instructions and teaching methods to create an inspiring Inclusive STEAM learning environment, giving appropriate feedback for all the above to all stakeholders.
Alternative label	Inclusive STEAM teacher primary school, STEAM primary school Inclusive teacher
Hierarchy	2- Professionals 23- Teaching professionals 234- Primary school and early childhood teachers 2343- Inclusive STEAM educators in primary school (new)
Essential skills and competences	Apply knowledge of Inclusive and Special Education Apply knowledge of the STEAM Education approach Identify and examine the impact of STEAM Education in Inclusive Educational Environments Assess, analyze and monitor learners' needs in Inclusive STEAM context Develop learners' profiles for Inclusive STEAM Education Integrate learners' prior knowledge and skills in Inclusive STEAM Educational procedure

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	Apply Inclusive STEAM teaching and learning techniques Apply teamwork methods and group dynamic methods for collaborative learning educational activities and projects Use appropriate resources and (Assistive Technology) tools according to learners' needs in Inclusive STEAM activities and projects Provide appropriate instructions according to learners' needs and profiles in Inclusive STEAM activities and projects Assess and analyze individual learners' activity/ project performance Assess and analyze group dynamics and interrelationships Provide appropriate feedback to all stakeholders Develop learners' STEAM portfolios Ensure accessibility and Inclusion in Inclusive STEAM Educational procedures Ensure all learners' active engagement in Inclusive STEAM activities/ projects Promote learners' confidence and self-efficacy in Inclusive STEAM activities/ projects Design and adapt Inclusive STEAM education curriculum of STEAM related general and special education disciplines Design and adapt Inclusive STEAM education course/lessons Design and adapt Inclusive STEAM education activities and projects Identify and select appropriate resources and (Assistive Technology) tools for Inclusive STEAM Education Design, create and adapt appropriate resources and instructions for Inclusive STEAM Education Facilitate all learners' STEAM competences Facilitate all learners' Inclusive competences Coordinate learners and group of learners during Inclusive STEAM educational activities and projects Coordinate team of educators and special education staff during a collaborative Inclusive STEAM teaching procedure Raise Inclusive STEAM Education awareness in the educational community Implement policies that promote STEAM Education and Inclusion Develop and apply personal transferable skills Develop and apply social transferable skills Develop and apply learning to learn transferable skills Develop and apply digital information and data literacy skills Manage and use digital tools for communication and collaboration in Inclusive STEAM education Select and use (self) evaluation practices and tools for Inclusive STEAM Education

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	Participate in lifelong learning related to STEAM, Inclusion and Inclusive STEAM educational approach
Essential knowledge	Inclusive and Special education principles Inclusive and Special education differences Developmental milestones in learning Children's physical development Disability types Signs and symptoms of disabilities Screening tools for disabilities STEAM educational approach Content knowledge of general and special education curricula of STEAM-related disciplines Constructivism theory of learning Constructivism teaching and learning techniques Teamwork principles Teamwork teaching and learning methods Teaching and learning techniques for Inclusive Education, STEAM Education and Special Education Assessment strategies for Inclusive Education, STEAM Education and Special Education Instructional means of Inclusive Education, STEAM Education and Special Education Legislation for Inclusive and Special Education
Optional skills and competences	Apply spatial and physical organization methods in Inclusive STEAM Classrooms Apply educational resources' management methods in Inclusive STEAM Education activities and projects Apply time management and learning organization methods for Inclusive STEAM activities and projects Participate and collaborate in local, national, and international educational communities, including schools and educators Engage with industry professionals and businesses Participate and collaborate in community organizations and institutions Apply action research procedures for reflection and improvement of educational procedures in Inclusive STEAM Education
Optional knowledge	Basic understanding of child psychology

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EQF level	5, 6

9.2. The STEAM Special educational needs primary school teacher occupational profile

Name	**STEAM Special educational needs primary school teacher**
Code	2343.2
Description	The Special educational needs STEAM teachers at Inclusive classrooms of primary schools provide specially-designed STEAM instructions to students with special educational needs (SEN), on a primary school level. They focus on differentiated and individualized teaching approaches in order to assist and instruct SEN students in STEAM Education activities and projects in Inclusive classrooms, facilitating the development of their STEAM and Inclusive competences. STEAM special educational needs teachers assess the students' progress, taking into account their strengths and weaknesses and communicate their findings to parents, administrators and other parties involved. In addition, they collaborate with Inclusive STEAM primary teachers, helping them develop the learners' profiles and design and select the appropriate learning materials and lessons for all students.
Alternative label	Special educational needs STEAM primary school teacher, STEAM SEN teacher primary school
Hierarchy	2- Professionals 23- Teaching professionals 234- Primary school and early childhood teachers 2343- Inclusive STEAM educators in primary school (new)
Essential skills and competences	Apply knowledge of Inclusive and Special Education Apply knowledge of the STEAM Education approach Identify and examine the impact of STEAM Education in Inclusive Educational Environments

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	Assess, analyze and monitor SEN learners' needs in Inclusive STEAM context Develop SEN learners' profiles for Inclusive STEAM Education Integrate SEN learners' prior knowledge and skills in Inclusive STEAM Educational procedure Apply Inclusive/ Special Education STEAM teaching and learning techniques Apply teamwork methods and group dynamic methods for collaborative learning educational activities and projects Use appropriate resources and (Assistive Technology) tools according to SEN learners' needs in Inclusive STEAM activities and projects Provide appropriate instructions according to SEN learners' needs and profiles in Inclusive STEAM activities and projects Assess and analyze individual SEN learners' activity/ project performance Assess and analyze group dynamics and interrelationships Provide appropriate feedback to all stakeholders Develop SEN learners' STEAM portfolios Ensure accessibility and inclusion in Inclusive STEAM Educational procedures Ensure SEN learners' active engagement in Inclusive STEAM activities/ projects Promote SEN learners' confidence and self-efficacy in Inclusive STEAM activities/ projects Design and adapt Inclusive STEAM education course/lessons Design and adapt Inclusive STEAM education activities and projects Identify and select appropriate resources and (Assistive Technology) tools for Inclusive STEAM Education Design, create and adapt appropriate resources and instructions for Inclusive STEAM Education Facilitate SEN learners' STEAM competences Facilitate SEN learners' Inclusive competences Coordinate SEN learners and group of learners during Inclusive STEAM educational activities and projects Implement policies that promote STEAM Education and Inclusion Raise Inclusive STEAM Education awareness in the educational community Develop and apply personal transferable skills Develop and apply social transferable skills Develop and apply learning to learn transferable skills Develop and apply digital information and data literacy skills Manage and use digital tools for communication and collaboration in Inclusive STEAM education Select and use (self) evaluation practices and tools for Inclusive STEAM Education

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	Participate in lifelong learning related to STEAM, Special Education, Inclusion and Inclusive STEAM educational approach
Essential knowledge	Inclusive and Special education principles Inclusive and Special education differences Developmental milestones in learning Children's physical development Disability types Signs and Symptoms of disabilities Screening tools for disabilities STEAM educational approach Constructivism theory of learning Constructivism teaching and learning techniques Teamwork principles Teamwork teaching and learning methods Teaching and learning techniques for Inclusive Education, STEAM Education and Special Education Assessment strategies for Inclusive Education, STEAM Education and Special Education Instructional means of Inclusive Education, STEAM Education and Special Education Legislation for Special Education and Inclusive Education
Optional skills and competences	Apply spatial and physical organization methods in Inclusive STEAM Classrooms Apply educational resources' management methods in Inclusive STEAM Education activities and projects Apply time management and learning organization methods for Inclusive STEAM activities and projects Participate and collaborate in local, national, and international educational communities, including schools and educators Engage with industry professionals and businesses Participate and collaborate in community organizations and institutions Apply action research procedures for reflection and improvement of educational procedures in Inclusive STEAM Education
Optional knowledge	Basic understanding of child psychology
EQF level	5, 6

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9.3. The Inclusive STEAM learning support teacher occupational profile

Name	**Inclusive STEAM learning support teacher**
Code	2343.3
Description	The Inclusive STEAM learning support teachers assist students who have general learning difficulties, in order for them to be able to participate in Inclusive STEAM activities and projects. Inclusive STEAM learning support teachers focus on basic skills of STEAM related disciplines, such as numeracy and literacy and thus teach and assist students on basic subjects such as writing, reading, math and languages. They support students in their school work in Inclusive STEAM activities and projects, plan learning strategies for the students' successful inclusion and participation in such activities, identify their learning needs and progress, and act accordingly.
Alternative label	STEAM learning support teacher SEN students
Hierarchy	2- Professionals 23- Teaching professionals 234- Primary school and early childhood teachers 2343- Inclusive STEAM educators in primary school (new)
Essential skills and competences	Apply knowledge of Inclusive and Special Education Apply knowledge of the STEAM Education approach Assess, analyze and monitor the needs of the learner(s) they support in Inclusive STEAM context Develop the learning profiles of the learner(s) they support Integrate the prior knowledge and skills of the learner(s) they support in Inclusive STEAM Educational procedures Apply Inclusive/ Special Education STEAM teaching and learning techniques Use appropriate resources and (Assistive Technology) tools according to the needs of the learner(s) they support in Inclusive STEAM activities and projects Provide appropriate instructions according to the needs and profiles of the

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	learner(s) they support in Inclusive STEAM activities and projects Assess and analyze the individual activity/ project performance of the learner(s) they support Provide appropriate feedback to all stakeholders Develop STEAM portfolios of learner(s) they support Ensure accessibility and inclusion in Inclusive STEAM Educational procedure Ensure the active engagement of the learner(s) they support in Inclusive STEAM activities/ projects Promote the confidence and self-efficacy of the learner(s) they support in Inclusive STEAM activities/ projects Design and adapt Inclusive STEAM education course/lessons Design and adapt Inclusive STEAM education activities and projects Identify and select appropriate resources and (Assistive Technology) tools for Inclusive STEAM Education Design, create and adapt appropriate resources and instructions for Inclusive STEAM Education Facilitate the STEAM competences of the learner(s) they support Facilitate the Inclusive competences of the learner(s) they support Coordinate learner(s)they support during Inclusive STEAM educational activities and projects Implement policies that promote STEAM Education and Inclusion Raise Inclusive STEAM Education awareness in the educational community Develop and apply personal transferable skills Develop and apply social transferable skills Develop and apply teamwork, collaboration and cooperation skills Develop and apply learning to learn transferable skills Develop and apply digital information and data literacy skills Manage and use digital tools for communication and collaboration in Inclusive STEAM education Select and use (self) evaluation practices and tools for Inclusive STEAM Education Participate in lifelong learning related to STEAM, Inclusion and Inclusive STEAM educational approach
Essential knowledge	Inclusive and Special education principles Inclusive and Special education differences STEAM educational approach Developmental milestones in learning Children's physical development Disability types

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	Signs and symptoms of disabilities Screening tools for disabilities Constructivism theory of learning Constructivism teaching and learning techniques Content knowledge of general and special education curricula of STEAM-related disciplines Teaching and learning techniques for Inclusive Education, STEAM Education and Special Education Assessment strategies for Inclusive Education, STEAM Education and Special Education Instructional means of Inclusive Education, STEAM Education and Special Education
Optional skills and competences	Apply teamwork methods and group dynamic methods for collaborative learning educational activities and projects Assess and analyze group dynamics and interrelationships Design and adapt Inclusive STEAM education curriculum of STEAM related general and special education disciplines Apply spatial and physical organization methods in Inclusive STEAM classrooms Apply educational resources' management methods in Inclusive STEAM Education activities and projects Apply time management and learning organization methods for Inclusive STEAM activities and projects Engage with industry professionals and businesses Apply action research procedures for reflection and improvement of educational procedures in Inclusive STEAM Education
Optional knowledge	Teamwork principles Teamwork teaching and learning methods
EQF level	4, 5

9.4. The Inclusive STEAM pedagogy expert occupational profile

Name	**Inclusive STEAM pedagogy expert**

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Code	2343.4
Description	The Inclusive STEAM pedagogy experts assist the leading educator in implementing the Inclusive STEAM Education procedure. They use and suggest a variety of practical and equitable Inclusive and STEAM teaching approaches in the classroom and help educators in designing and adapting STEAM curriculum, activities, projects, resources and tools using Inclusive frameworks and techniques. They continuously enhance their knowledge and skills in Inclusive Education, STEAM Education and Inclusive STEAM Education, whereas they collaborate with community members for the better implementation of STEAM Education activities and projects, fostering their awareness on Inclusive Education, its necessity and its needs.
Alternative label	Inclusive STEAM mentor
Hierarchy	2- Professionals 23- Teaching professionals 234- Primary school and early childhood teachers 2343- Inclusive STEAM educators in primary school (new)
Essential skills and competences	Apply knowledge of Inclusive and Special Education Apply knowledge of the STEAM Education approach Identify and examine the impact of STEAM Education in Inclusive Educational Environments Assess, analyze and monitor learners' needs in Inclusive STEAM context Develop learners' profiles for Inclusive STEAM Education Integrate learners' prior knowledge and skills in Inclusive STEAM Educational procedure Apply Inclusive STEAM teaching and learning techniques Apply teamwork methods and group dynamic methods for collaborative learning educational activities and projects Use appropriate resources and (Assistive Technology) tools according to learners' needs in Inclusive STEAM activities and projects Provide appropriate instructions according to learners' needs and profiles in Inclusive STEAM activities and projects Assess and analyze individual learners' activity/ project performance Assess and analyze group dynamics and interrelationships

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	Provide appropriate feedback to all stakeholders Develop learners' STEAM portfolios Ensure accessibility and Inclusion in Inclusive STEAM Educational procedures Ensure all learners' active engagement in Inclusive STEAM activities/ projects Promote learners' confidence and self-efficacy in Inclusive STEAM activities/ projects Design and adapt Inclusive STEAM education curriculum of STEAM related general and special education disciplines Design and adapt training program frameworks for Inclusive STEAM Education Design and adapt Inclusive STEAM education course/lessons Design and adapt Inclusive STEAM education activities and projects Identify, evaluate and select appropriate resources and (Assistive Technology) tools for Inclusive STEAM Education Design, create and adapt appropriate resources and instructions for Inclusive STEAM Education Facilitate all learners' STEAM competences Facilitate all learners' Inclusive competences Coordinate learners and group of learners during Inclusive STEAM educational activities and projects Coordinate team of educators and special education staff during a collaborative Inclusive STEAM teaching procedure Participate and collaborate in local, national, and international educational communities, including schools and educators Implement policies that promote STEAM Education and Inclusion Engage with industry professionals and businesses Participate and collaborate in community organizations and institutions Raise Inclusive STEAM Education awareness in the educational community Develop and apply personal transferable skills Develop and apply social transferable skills Develop and apply learning to learn transferable skills Develop and apply digital information and data literacy skills Develop skills for successful mentoring Manage and use digital tools for communication and collaboration in Inclusive STEAM education Select and use (self) evaluation practices and tools for Inclusive STEAM Education Participate in lifelong learning related to STEAM, inclusion and Inclusive STEAM educational approach Apply action research procedures for reflection and improvement of educational

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	procedures in Inclusive STEAM Education
Essential knowledge	Inclusive and Special education principles Inclusive and Special education differences Developmental milestones in learning Children's physical development Disability types Signs and symptoms of disabilities Screening tools for disabilities STEAM educational approach Content knowledge of general and special education curricula of STEAM-related disciplines Constructivism theory of learning Constructivism teaching and learning techniques Teamwork principles Teamwork teaching and learning methods Teaching and learning techniques for Inclusive Education, STEAM Education and Special Education Assessment strategies for Inclusive Education, STEAM Education and Special Education Instructional means of Inclusive Education, STEAM Education and Special Education Legislation of Inclusive and Special Education
Optional skills and competences	Apply spatial and physical organization methods in Inclusive STEAM Classrooms Apply educational resources' management methods in Inclusive STEAM Education activities and projects Apply time management and learning organization methods for Inclusive STEAM activities and projects Listening actively Building trust Encouraging Instructing/ developing capabilities Providing corrective feedback Inspiring
Optional knowledge	Basic understanding of child psychology

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EQF level	6,7

10. Conclusions

In conclusion, this report represents a significant follow-up to the findings of Task 2.1, as it provides valuable insights into the necessary competences that educators should develop to successfully implement Inclusive STEAM Education in the primary education context. Additionally, it offers valuable insights into the required occupational profiles for the successful implementation of this complex educational approach in the same context.

These insights, in conjunction with the other deliverables from WP2 (STEAM Educational Framework and GAP Analysis), will play a vital role in subsequent work packages of the SpicE project. Specifically, they will inform the design and

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development of a comprehensive professional development program for primary educators engaged in Inclusive STEAM education.

Crucially, the Competence Framework outlined in this report will serve as a cornerstone for this program. It will provide essential guidance and structure to design and deliver effective training initiatives that enhance the competence and expertise of Inclusive STEAM primary educators. By incorporating these findings into the program, the SpicE project aims to support educators in their journey towards implementing inclusive and impactful STEAM education practices in the primary education landscape.

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ANNEXES

ANNEX 1: STEAM Educators' Competence Framework

STE(A)M educators' Competence Framework
1. Educator as teacher-trainer-tutor / implementing the educational procedure
1.1 Pedagogy
1.1.1 Apply teaching and learning techniques that promote STE(A)M education (e.g. inquiry-based learning, problem-based , game-based learning techniques that enhance complex questions developing critical thinking, exploring social issues and developing solutions to real problems)
1.1.2 Apply teamwork methods and group dynamic techniques for collaborative learning activities (e.g. collaborative techniques which guide learners to cooperate and communicate with each other effectively)
1.1.3 Promote student-centered learning in STE(A)M educational activities (e.g. activities where learners design, reflect, search for information, share ideas and discover creative solutions to problems.)
1.1.4 Provide guidance and support in STEAM educational activities
1.1.5 Implement integrated curricula for STEAM education
1.2 STEAM educationfoundations
1.2.1 Understand the differences of STEM education as compared to integrated STEAM education
1.2.2 Understand the contribution of Arts (A) to STE(A)M
1.3 Use of content and tools
1.3.1 Identify appropriate content, educational material and tools for STE(A)M education
1.3.2 Select appropriate content, educational material and tools for STE(A)M education
1.3.3 Use appropriate content, educational material and tools for STE(A)M education

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1.4 Feedback and Assessment
1.4.1 Use diversity and suitable assessment formats and approaches for both formative and summative assessment
1.4.2 Analyse and learner activity performance and progress in order to inform teaching and learning
1.4.3 Provide targeted and timely feedback to learners
1.5 Learner empowerment
1.5.1 Ensure accessibility and inclusion in STE(A)M related-educational procedures
1.5.2 Ensure active engagement of learners in STE(A)M related-educational procedures
1.5.3 Ensure differentiation and personalization in STE(A)M related-educational procedures
2. Educator as learning designer and creator / designing and creating learning opportunities
2.1 Educational design
2.1.1 Design educational learning objects for STE(A)M education
2.1.2 Develop educational learning objects for STE(A)M education
2.1.3 Design educational units for STE(A)M education
2.1.4 Create educational tools for STE(A)M education
2.2 Learner development
2.2.1 Facilitate learners' STE(A)M competences
2.2.2 Provide guidance on STE (A) M related learning experiences
3. Educator as orchestrator / coordinating procedures and outputs
3.1 Educational procedure and resource coordination

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3.1.1 Apply teaching and learning organization methods for STE(A)M education
3.1.2 Apply educational resources management methods for STE(A)M education
3.1.3 Apply teaching space management methods in STE(A)M education
3.2 Stakeholders' coordination
3.2.1 Coordinate learners and group of learners during STE(A)M related activities
3.2.2 Coordinate team of educators during a collaborative STE(A)M teaching procedure
4. Educator as community member / interacting with the environment
4.1 Community building
4.1.1 Engage in STE(A)M communities of educators
4.1.2 Engage in institutional-based communities for STE(A)M education
4.1.3 Engage in research and business communities for STE(A)M education
4.2 Application of policies
4.2.1 Implement policies that promote STE(A)M education
4.2.2 Reinforce STE(A)M education awareness in the educational community (learners, educators, parents etc.)
5. Educator as professional / developing and applying competences
5.1 Transferable skills
5.1.1 Develop presentation and communication skills
5.1.2 Develop critical thinking and problem-solving skills
5.1.3 Apply ethic skills
5.1.4 Develop entrepreneurship skills

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5.2 Digital skills
5.2.1 Apply information and data literacy skills
5.2.2 Use digital tools for communication and collaboration in STEAM education
5.2.3 Create digital content for STE(A)M education
5.2.4 Apply privacy and copyright rules in digital content for STEAM education
5.2.5 Use digital technologies in STEAM education
5.3 Professional development
5.3.1 Adapt self-reflective practices for STE(A)M education
5.3.2 Participate in lifelong learning experiences related to STE(A)M educational approach
5.3.3 Apply action research procedures for reflection and improvement of educational procedures in STEAM education

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ANNEX 2: The revised version of Inclusive STEAM Educators' Competence Framework

Competences' Areas	Competences
1. Educator as an Inclusive STEAM teacher- trainer-tutor/ implementing the Inclusive STEAM educational procedure	
1.1. Inclusive STEAM Education foundations	*1.1.1. Demonstrate knowledge on Inclusive and Special Education*
	1.1.2. Demonstrate knowledge on the STEAM education approach
	1.1.3. Understand the added value of STEAM approach in Inclusive Education
1.2. Learners' profiling in Inclusive STEAM classrooms	*1.2.1. Assess, analyze and monitor learners' needs in Inclusive STEAM context*
	1.2.2. Develop learners' profiles for Inclusive STEAM Education
1.3. Pedagogies in Inclusive STEAM classrooms	*1.3.1. Integrate learners' prior knowledge and skills in Inclusive STEAM educational procedure*
	1.3.2. Apply Inclusive STEAM teaching and learning techniques in Inclusive STEAM classrooms
	1.3.3. Apply teamwork methods and group dynamic techniques for collaborative learning educational activities in Inclusive STEAM classrooms

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1.4 Inclusive STEAM resources and instructions	*1.4.1. Use appropriate resources in Inclusive STEAM classrooms*
	1.4.2. Provide appropriate instructions in Inclusive STEAM classrooms
1.5. Assessment and feedback in Inclusive STEAM classrooms	*1.5.1. Assess and analyze individual learners' activity/project performance in Inclusive STEAM classrooms*
	1.5.2. Assess and analyze group dynamics and interrelationships in Inclusive STEAM classrooms
	1.5.3. Provide appropriate feedback to all stakeholders
	1.5.4. Develop learners' STEAM portfolios
1.6. Empowering learners in Inclusive STEAM classrooms	*1.6.1. Ensure accessibility in Inclusive STEAM learning*
	1.6.2. Ensure all learners' active engagement in Inclusive STEAM activities/projects
2. Educator as an Inclusive STEAM Education designer and creator/ designing and creating Inclusive STEAM opportunities	
2.1. Educational Design for Inclusive STEAM Education	*2.1.1. Design Inclusive STEAM education curricula of STEAM-related general and special education disciplines*
	2.1.2. Design Inclusive STEAM education courses/lessons
	2.1.3. Design Inclusive STEAM educational activities/projects
2.2. Educational Design for Inclusive STEAM resources and Instructions	*2.2.1. Select and adapt appropriate resources for Inclusive STEAM education*
	2.2.2. Design and create appropriate resources and Instructions for Inclusive STEAM Education

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2.3. Learners' development	*2.3.1. Facilitate learners' STEAM competences*
	2.3.2. Facilitate learners' Inclusive competences
3. Educator as an Inclusive STEAM orchestrator / coordinating Inclusive STEAM procedures, resources, and classroom's members	
3.1. Inclusive STEAM educational procedures and resources coordination	*3.1.1. Apply educational resources' management methods in Inclusive STEAM classrooms*
	3.1.2. Apply teaching and learning organization methods for Inclusive STEAM education
	3.1.3. Apply teaching space management methods in Inclusive STEAM classrooms
3.2. Inclusive STEAM classroom's members coordination	*3.2.1. Coordinate learners and groups of learners during Inclusive STEAM educational activities*
	3.2.2. Coordinate team of educators and special education staff during a collaborative inclusive STEAM teaching procedure
4. Educator as a community member/ interacting with the environment	
4.1. Community building	*4.1.1. Engage in Inclusive STEAM communities of educators*
	4.1.2. Engage in educational communities for Inclusive STEAM Education
	4.1.3. Engage in research and business communities for Inclusive STEAM Education
4.2. Application of policies and community awareness raising	*4.2.1. Implement policies that promote STEAM Education and Inclusion*
	4.2.2. Raise Inclusive STEAM education awareness in the educational community (learners, educators, learners' legal guardians etc.)

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5. Educator as a growing Inclusive STEAM professional/ developing and applying competences	
5.1. Transferable skills	*5.1.1. Develop and apply personal transferable skills*
	5.1.2. Develop and apply social transferable skills
	5.1.3. Develop and apply learning to learn transferable skills
5.2. Digital skills	*5.2.1. Apply information and data literacy skills*
	5.2.2. Manage and use digital tools for communication and collaboration in Inclusive STEAM education
5.3. (Self) reflective and lifelong learning skills	*5.3.1. Select and use (self)reflective practices and tools for Inclusive STEAM Education*
	5.3.2. Participate in lifelong learning related to STEAM, Inclusion, and Inclusive STEAM educational approach
	5.3.3. Apply action research procedures for reflection and improvement of educational procedures in inclusive STEAM Education

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ANNEX 3: The Inclusive STEAM Educators' Competence Framework

Competence Areas (Areas within roles in which Inclusive STEAM Educators should possess competences)	Competences	Examples of competences statements (What Inclusive STEAM Educators should know and do, in order to acquire the competence)
1.Educator as an Inclusive STEAM teacher- trainer-tutor/ implementing the Inclusive STEAM educational procedure		
1.1. Inclusive STEAM Education foundations	1.1.1. Demonstrate and apply knowledge of Inclusive and Special Education	*To mention basic principles and differences of Inclusive and Special Education, as well as their effects on school practice* *To describe important characteristics of Instructional means for implementing Inclusive Education, such as Inclusive frameworks like Universal Design of Learning (UDL) and techniques such as Differentiation of Instruction (DI)* *To describe important characteristics of Instructional means for Special Education, such as the Individualized Lesson Plan (ILP)* *To understand the great value and necessity of those frameworks and techniques* *To know when and why to use such frameworks and techniques* *To apply knowledge of Inclusive and Special education in everyday school practice*
	1.1.2.Demonstrateand	*To understand STEAM education as an integrated approach of STEM subject in combination with other subjects (Arts), e.g.*

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	apply knowledge of the STEAM education approach	*audiovisual arts, lyrics, humanities and social science subjects etc.* *To understand the dynamic interaction of all fields of STEAM Education* *To recognize that STEAM Education is an approach to learning that uses Science, Technology, Engineering, the Arts and Mathematics as access points for guiding student inquiry, dialogue, and critical thinking.* *To recognize that STEAM education approach aims to prepare active and functioning citizens in a scientifically and technologically society* *To recognize the collaborative and group dynamic techniques needed for the success of STEAM Education* *To name significant benefits of STEAM Education* *To name important advantages and disadvantages of the interdisciplinary, transdisciplinary and separate-fields approaches of STEAM Education* *To apply knowledge of STEAM education in everyday school practice*
	1.1.3.Identify and examine the impact of STEAM Education in Inclusive Educational Environments	*To be aware of the impact of STEAM education practices in the inclusion of all learners (with or without disabilities, minorities, learners with different socioeconomic and cultural background)* *To recognize and examine the necessity of STEAM Education in the development of all learners' needed knowledge and skills as defined from future societies and labour markets* *To identify the added value of STEAM approach in the creation of educational scenarios for all learners whose aims could not be achieved through traditional teaching method* *To examine and name the main advantages of Inclusive STEAM Education and the main prerequisites for its successful application*
1.2.Learners' profiling in Inclusive STEAM classrooms	1.2.1.Assess, analyze and monitor learners' needs in Inclusive STEAM context	*To demonstrate knowledge of developmental milestones of learning* *To recognize the stages of learners' cognitive, mental, social, emotional, physical and psychological development and their influence on learning* *To be aware of learners' socioeconomic and cultural background and its influence on learning* *To acquire knowledge from previous learners' (STEAM) assessments and (STEAM) portfolios* *To identify, assess, select and use different types and techniques of learners' needs assessment*

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		To assess learners' language use and acquisition, skills, STEAM knowledge and skills and learners' behaviours *To identify learners' needs, learning styles, talents, interests and motives concerning STEAM education* *To engage learners to self-reflect in their needs assessment process* *To pinpoint as accurately as possible the gap between learners' existing and targeted knowledge and skills in STEAM context and their existing and targeted behaviours* *To investigate the origin of learners' needs and of the gaps between their existing and targeted knowledge and skills in STEAM context and their existing and targeted behaviours* *To collaborate with learners' legal guardians and other educators for the further identification of learners' needs and investigation of their origin* *To recognize signs and symptoms of disabilities* *To recognize learners' strengths and weaknesses on STEAM learning and cognition because of disabilities* *To identify, select and use screening tools for (possible) signs of disabilities* *To monitor learners' needs in STEAM context*
	1.2.2. Develop learners' profiles for Inclusive STEAM Education	*To combine knowledge from learners' needs assessment and identification, screening of learners' (possible) signs of disabilities and pedagogical STEAM learners'/ group of learners' assessment for creating learners' profiles for Inclusive STEAM Education* *To describe in detail learners' preferences, strengths, and weaknesses in reference to specific field, goals or objectives of Inclusive STEAM Education* *To create an observable and measurable account of each learner's learning abilities in Inclusive STEAM Education*
1.3. Teaching methods and practices in Inclusive STEAM classrooms	1.3.1.Integrate learners' prior knowledge and skills in Inclusive STEAM Educational procedure	*To know, understand and apply the principles and techniques of constructivism theory of learning* *To recognize the necessity of identification and integration of learners' prior knowledge and skills in teaching and learning process* *To identify learners' prior knowledge and mental representations of concepts under study through constructivism techniques (e.g. brainstorming, exploratory discussions, deductive approaches)* *To identify learners' confusions, misinterpretations and misunderstandings of concepts under study through constructivism techniques (e.g., brainstorming, exploratory*

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		discussions, deductive approaches) *To promote learners' conceptual change on concepts under study through constructivism techniques (e.g., cognitive conflicts)* *To make connections of new knowledge of concepts under study with learners' prior knowledge* *To facilitate learners to develop new STEAM related skills (e.g. problem- solving, critical thinking, decision making, skills from STEAM disciplines) based on their prior skills*
	1.3.2.Apply Inclusive STEAM teaching and learning techniques in Inclusive STEAM classrooms	*To know and understand STEAM learning theories and STEAM teaching and learning techniques (e.g., flipped learning, inquiry-based learning, project-based learning, research based learning, problem-based learning, game- based learning, outdoor learning)* *To use STEAM teaching and learning techniques in order to support all learners' engagement on complex questions and promote the development of all learners' critical thinking, their exploration on social issues and the development of solutions to complex real life problems* *To know, understand and use techniques for self-regulated learning processes where all learners design, reflect, search for information, share ideas and discover creative solutions to problems in Inclusive STEAM classrooms.* *To know, understand and use student-centered learning approaches in Inclusive STEAM classrooms* *To know, understand and apply Inclusive and Special Education teaching and learning techniques (such as the Universal Design of learning (UDL), the Differentiation of Instruction (DI) and the Individualized Lesson Plans (ILP)) in Inclusive STEAM classrooms* *To combine STEAM teaching and learning techniques with Inclusive/Special Education teaching and learning techniques (e.g., UDL, DI, ILP) for developing and delivering effective Inclusive STEAM teaching and learning* *To produce combinations of evidence-based methods, techniques, and means for achieving the goals and objectives set in the (personalized) instructional programs* *To justify the specific way the interventions have been implemented to other educators/ special educators/ school staff/ headmasters/ learners' legal guardians* *To describe alternative ways for implementing the program to other educators/ special educators/ school staff/ headmasters, provided that the necessary resources were available*

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	1.3.3. Apply teamwork methods and group dynamic methods for collaborative learning educational activities in Inclusive STEAM classrooms	*To know, understand and use group dynamics methods (e.g., collaborative methods which guide all learners to cooperate and communicate with each other effectively, peer tutoring and learning strategies)* *To know, understand and use teamwork methods.*
1.4. Inclusive STEAM resources and Instructions	1.4.1. Use appropriate resources and (Assistive Technology) tools according to learners' needs and profiles in Inclusive STEAM activities and projects	*To select and provide appropriate format or type of STEAM content, educational materials and tools for each learner's needs* *To use and modify on the spot, educational material and tools in order to meet all learners' needs* *To select different Assistive Technology tools (e.g. audio recorders, organizers, calculators, pencil grips, highlighter pens, screen readers, speech to text apps, word processing apps, audio books, robots etc) according to all learners' needs* *To use the appropriate for their needs and for the STEAM activity/task Assistive Technology Tool*
	1.4.2 Provide appropriate Instructions according to learners' needs and profiles in Inclusive STEAM activities and projects	*To use language that it is appropriate for learners' age and needs in Inclusive STEAM classrooms* *To use different modes of language expression (visual, spatial, aural and gestural) for Instructions in Inclusive STEAM classroom* *To use different modes of Instructions (whole class Instruction, one to one Instruction, one to small group Instruction) in Inclusive STEAM classroom* *To provide differentiated Instructions in Inclusive STEAM classroom according to learners' ability as assessed from learners' profiling* *To justify the specific way Instructions had been provided in Inclusive STEAM classrooms to other educators/ special educators/ school staff/ headmasters/ learners' legal guardians*
1.5. Assessment and feedback in Inclusive STEAM classrooms	1.5.1. Assess and analyze individual learners' activity/project performance in Inclusive STEAM classrooms	*To know, understand, select and apply multiple forms and alternative ways of learners' performance assessment in Inclusive STEAM activities/projects* *To know, understand and apply both formative and summative assessment in ways that are appropriate to the level and purpose of the learning and meet the needs of all learners.* *To collaborate with other general and special educators and staff participating in Inclusive STEAM activities/ projects in individual learners' assessment process*

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		To facilitate all learners' self-assessment strategies in Inclusive STEAM activities/projects. *To know, understand and be able to keep detailed and diagnostic records and data of STEAM related activities/projects assessment* *To analyze learners' engagement, performance and progress in Inclusive STEAM activities/projects* *To specify the extent to which the implemented Inclusive STEAM educational procedure brought about the intended change in all learners* *To specify the reasons for the degree of all learners' success in the Inclusive STEAM educational process*
	1.5.2. Assess and analyze group dynamics and interrelationships in Inclusive STEAM classrooms	*To know, understand, select and apply multiple forms of group dynamics performance and interrelationships assessment in Inclusive STEAM activities/ projects* *To collaborate with other general and special educators and staff participating in Inclusive STEAM activities/ projects in group dynamics performance and interrelationships assessment* *To know, understand and be able to keep detailed and diagnostic records and data of group dynamics, performance and interrelationships assessment in Inclusive STEAM activities/ projects* *To analyze group's engagement, activity performance and progress in Inclusive STEAM activities/projects*
	1.5.3. Provide appropriate feedback to all stakeholders	*To provide coherently, targeted and timely feedback to learners/ group of learners about their progress* *To monitor learners'/ group of learners' misunderstandings, giving feedback and guidance to them where appropriate.* *To describe learners'/ group of learners' lesson performance by providing regular feedback to all stakeholders.* *To provide coherently, targeted and timely feedback to learners' legal guardians/ other educators and stakeholders about the learners' progress, needs, challenges and (possible) signs of disabilities.* *To describe clearly the interactions prevailing in the specific learning environment among learners, curriculum, resources and other important factors or agents to all stakeholders* *To present detailed information of the dynamics of the classroom to all stakeholders*
	1.5.4. Develop learners' STEAM portfolios	*To understand the necessityof learners' portfolios' development in assessment and design of Inclusive STEAM Education* *To identify and select appropriate for every learner's needs portfolio type(s)(e.g. individual portfolios, group portfolios)*

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		To identify and select appropriate format(s) of learners' STEAM portfolios (e.g. digital portfolios, traditional portfolios) *To create and update STEAM portfolios for all learners* *To collaborate with other general and special educators and staff participating in Inclusive STEAM activities/ projects in the development and updating of learners' portfolios*
1.6. Learners' empowerment in Inclusive STEAM classrooms	1.6.1. Ensure accessibility and inclusion in Inclusive STEAM educational procedure	*To reassure access of all learners, including those with special needs, different cultural backgrounds and minorities to all the stages of educational procedure* *To address inclusion and diversity issues within the classroom during educational procedure* *To address prejudice and stereotypes in Inclusive STEAM educational procedure* *To raise disability awareness and promote multi- cultural and multi-ethnic understanding through Inclusive STEAM activities/ projects* *To participate in educational organization procedures for providing appropriate for the learners' needs and each STEAM activity/ task Assistive Technology Tools and resources*
	1.6.2.Ensure all learners' active engagement in Inclusive STEAM activities/ projects	*To know, understand and be able to use techniques to enhance the active participation of learners as well as the interaction between them by providing appropriate guidance and assistance during STEAM activities and projects.* *To provide guidance to learners in order to communicate with each other, and to suggest different points of view by developing an open learning environment for creative problem solving during STEAM activities and projects.* *To use diverse approaches and strategies and provide a variety of stimulating tasks to trigger and maintain learners' active engagement and strong internal motivation* *To identify signs of low motivation in learners and implement the measures needed to remedy the situation*
	1.6.3. Promote learners' confidence and self-efficacy in Inclusive STEAM activities/ projects	*To ensure an appropriate culture of learning in order to empower learners in Inclusive STEAM classrooms* *To provide opportunities to all learners to develop their skills and abilities in Inclusive STEAM activities/ projects* *To provide opportunities to all learners to share and use their talents in Inclusive STEAM activities/ projects* *To celebrate all learners' successes in Inclusive STEAM activities/ projects*
2. Educator as an Inclusive STEAM Education designer and creator/ designing and creating Inclusive STEAM opportunities		

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2.1. Educational Design for Inclusive STEAM Education	2.1.1. Design and adapt Inclusive STEAM Education curriculum of STEAM-related general and special education disciplines	*To be aware of general and special education STEAM-related disciplines curriculum* *To set documented priorities with regard to the fields on which STEAM Education will concentrate* *To formulate clear, observable, and measurable STEAM –related disciplines goals* *To recognize design methods for creating transdisciplinary/ integrative curriculum (e.g. backward design, collaborative design etc)* *To select and implement appropriate design method to create flexible transdisciplinary STEAM curriculum based on real life problems* *To set documented priorities with regard to the fields on which Inclusive Education will concentrate* *To formulate clear, observable and measurable Inclusive Education goals* *To merge desired STEAM- related disciplines' goals and Inclusive Education's goals in order to define Inclusive STEAM Education goals* *To adapt the transdisciplinary STEAM curriculum and goals into Inclusive STEAM curriculum and goals in order to address and meet all learners' needs using Inclusive educational frameworks such as UDL*
	2.1.2 Design and adapt Inclusive STEAM education courses/lessons	*To select and formulate desired Inclusive STEAM lesson's goals* *To convert selected Inclusive STEAM lesson's goals into specific, measurable, achievable, realistic, and time-bound (SMART) Inclusive STEAM objectives* *To formulate SMART Inclusive STEAM lesson's objectives for every learner according to his/ her needs and STEAM knowledge and skills* *To select and use appropriate lesson planning/ STEAM lesson planning technique for all learners' needs* *To develop Inclusive STEAM lesson plan(s) by defining all learners' objectives, learning activities, assessments, lesson's sequence and timeline* *To select appropriate content, sequencing, breadth, balance and delivery means from the designed Inclusive STEAM curricula for the accomplishment of all learners' Inclusive STEAM objectives* *To develop Individualized STEAM lesson plan(s) if needed by defining learner's objectives, learning activities, assessments, lesson's sequence and timeline* *To formulate supplementary SMART STEAM and/or Inclusive*

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		objectives for specific or all learners if needed *To merge supplementary SMART STEAM and Inclusive objectives into SMART Inclusive STEAM objectives for specific or all learners* *To redesign Inclusive STEAM lesson, lesson's plan(s)/ Individualized STEAM lesson plan(s) if needed* *To adapt the designed Inclusive STEAM lessons and (Individualized) lessons' plans to the specific instructional environment and its infrastructures*
	2.1.3. Design and adapt Inclusive STEAM educational activities and projects	*To effectively design Inclusive STEAM educational activities and projects based on Inclusive STEAM lesson plan(s) and/ or Individual STEAM lesson plan(s)* *To design Inclusive STEAM educational activities and projects based on real life situations.* *To design Inclusive STEAM related educational activities and projects based on learners' needs, characteristics, STEAM knowledge and skills and educational Inclusive STEAM objectives of the lesson* *To adapt the designed Inclusive STEAM activities to the specific instructional environment and its infrastructures* *To adapt the designed Inclusive STEAM activities to the society's and labour market's needs (e.g. by incorporating coding and technology skills relevant to the digital job market)*
2.2. Educational Design for Inclusive STEAM resources and Instruction	2.2.1.Identify and select appropriate resources and (Assistive Technology) tools for Inclusive STEAM Education	*To identify existing STEAM/ Inclusive STEAM frameworks/ methods/ content/ learning objects/ tools/ apps/ software/ assessment tools and AT tools* *To assess if the identified STEAM/ Inclusive STEAM frameworks/ methods/ content/ learning objects/ apps/ software/ tools/assessment tools and AT tools are appropriate for all learners' needs* *To select STEAM/ Inclusive STEAM frameworks/ methods/ content/ learning objects/apps/ software/ tools/ assessment tools and AT tools appropriate for each learners' needs* *To combine existing STEAM/ Inclusive STEAM frameworks/ methods/ content/ learning objects/ tools/ apps/ software/ assessment tools and AT tools for achieving goals and objectives set for all learners in the previous steps*
	2.2.2. Design, create and adapt appropriate resources and Instructions for Inclusive STEAM Education	*To use different frameworks, such as UDL and DI techniques, during the design process of STEAM content/ learning objects/apps/ tools/ assessment tools and Instructions in order to meet all learners' needs* *To create and develop a variety of resources (audiovisual material, etc.)* *To modify existing or designed STEAM/ Inclusive STEAM content/*

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		instructions/ learning objects/ tools/ assessment tools in order to meet each learners' needs *To build on existing or designed STEAM/ Inclusive STEAM content/ learning objects/ tools/ assessment tools and AT tools in order to meet each learner's needs*
2.3. Learners' development	2.3.1. Facilitate all learners' STEAM competences	*To facilitate learners' engagement with learning activities, assignments and assessments that would foster their:* *Cognitive skills - Information Processing skills - Data Interpretation and Data Analysis skills - Problem Solving and Engineering Thinking skills - Scientific Investigation skills - Computational Thinking and ICT skills - Design Thinking, Creativity and Innovation skills - Manipulative and Technological Skills - Collaboration and Communication Skills*
	2.3.2. Facilitate all learners' Inclusive competences	*To facilitate learners' engagement with learning activities, assignments and assessments which would help them to develop competences associated with Diversity, Equity, and Inclusion as:* *-Cultivating cultural awareness and belonging -Confronting bias - Mitigating microaggressions -Combating stereotypes - Multicultural and multi-ethnic understanding*
3. Educator as an Inclusive STEAM Education orchestrator / coordinating and managing Inclusive STEAM procedures, resources and classroom's members		
3.1. Inclusive STEAM educational procedures and resources coordination	3.1.1. Apply spatial and physical organization methods in inclusive STEAM Classrooms	*To create a safe and accessible Inclusive STEAM environment* *To create different STEAM activities'/project's learning centers within classroom* *To arrange classroom seating according to learners' needs* *To ensure accessibility in every learning center and whole classroom* *To organize and prepare classroom and laboratory learning spaces for Inclusive STEAM related activities/projects.* *To handle unexpected situations in the Inclusive STEAM classroom*
	3.1.2. Apply educational resources' management methods in Inclusive STEAM Education activities and projects	*To organize and prepare the necessary materials and educational resources for Inclusive STEAM related activities and projects.* *To manage and protect sensitive digital and non-digital content by applying privacy and copyright rules.* *To organize and prepare (lab) equipment for Inclusive STEAM activities and projects.*
	3.1.3. Apply time	*To coordinate the teaching procedure during Inclusive STEAM activities and projects*

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	management and learning organization methods for Inclusive STEAM activities and projects	*To assume the role of facilitator during the Inclusive STEAM educational process* *To respect learners' pace, providing extra or less time for the completion of lesson's activities and projects* *To carry out time management of (Individualized) Inclusive STEAM lesson plans.*
3.2. Inclusive STEAM classroom's members coordination	3.2.1. Coordinate learners and groups of learners during Inclusive STEAM educational activities and projects	*To select and use appropriate for learners' needs behavior management strategies* *To identify and assess different behavior management strategies* *To monitor learners' challenging behaviors* *To help learners to recognize, self-assess and appropriately manage their behaviors and emotions* *To facilitate the formation of groups of learners of varying ability levels during the implementation of Inclusive STEAM educational activities and projects* *To promote mutual help strategies within the Inclusive STEAM classrooms that are beneficial to all learners*
	3.2.2. Coordinate team of educators and special education staff during a collaborative Inclusive STEAM teaching procedure	*To present goals and objectives effectively and coherently to teams of educators and special education staff (e.g. special education school teachers, schools' psychologists/ occupational therapists etc.) and professionals (e.g. private parallel support teacher) during a collaborative Inclusive STEAM teaching procedure* *To give appropriate instructions to team of educators and special education staff and professionals during a collaborative Inclusive STEAM teaching procedure* *To manage team of educators and special education staff and professionals during a collaborative Inclusive STEAM teaching procedure*
4. Educator as a community member/ interacting with the environment		
4.1. Community building	4.1.1. Participate and collaborate in local, national, and international educational communities, including schools and educators	*To participate and collaborate within local, national, and international educational communities, including schools and educators, to foster knowledge sharing, professional growth, and innovative practices.* *To participate in online and offline local, national and international communities among educators in order to exchange experiences, knowledge, good practices, teaching methods and educational resources related to inclusive STEAM education* *To collaborate with educators from other educational institutions in order to promote Inclusive STEAM practices in schools*

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	4.1.2. Engage with industry professionals and businesses	*To establish meaningful connections and engage with industry professionals and businesses to bring real-world relevance to STEAM education, leveraging their expertise, resources, and experiences to enhance student learning and prepare them for future career pathways* *To cooperate with research and business communities (e.g. through collaborating research projects, sharing expertise and resources etc.)*
	4.1.3 Participate and collaborate in community organizations and institutions	*To participate and collaborate with community organizations and institutions, such as museums, science centers, and research institutes, to create enriching learning opportunities for students.* *To promote and support the participation of all learners in STEAM related competitions, events, festivals, online platforms etc. to give all learners the opportunity to present their work to the general public.*
4.2. Application of policies and community awareness raising	4.2.1. Implement policies that promote STEAM Education and Inclusion	*To apply education policies and procedures for Inclusion and STEAM education.* *To promote contextual, institutional, and organizational aspects of Inclusion and STEAM educational policies*
	4.2.2. Raise Inclusive STEAM education awareness in the educational community	*To participate in policy making decisions (e.g. through comments, feedback and proposals on legislation and official policy documents) for the Inclusive STEAM educational approach.* *To articulate the benefits of inclusive STEAM education to a variety of stakeholders, including learners, educators, learners' legal guardians, and community members.* *To communicate effectively with learners' legal guardians and other members of the educational community about the importance of inclusive STEAM education, and provide resources and support to help them engage with STEAM concepts and activities at home.* *To collaborate with other educators and community members to promote and reinforce inclusive STEAM education awareness,*

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		such as by organizing community events, sharing resources, and participating in professional development opportunities.
5. Educator as a growing Inclusive STEAM professional/ developing and applying competences		
5.1. Transferable skills[7]	5.1.1. Develop and apply personal transferable skills	*To develop and apply creativity and innovation, critical thinking, adaptability skills, design thinking, resiliency and self-control skills* *To have awareness and management of emotions, thoughts and behavior* *To be able to manage transitions and uncertainty and to face challenges.* *To pursuit of life satisfaction, care of physical, mental and social health and adoption of a sustainable lifestyle and sustainability principles even through the introduction of the Agenda 2030 and Sustainable Development goals*
	5.1.2. Develop and apply social transferable skills	*To be able to understand of another person's emotions, experiences and values, and provide appropriate responses.* *The use of relevant communication strategies, domain specific codes and tools, depending on the context and the content.* *To be able to engage in group activity and teamwork acknowledging and respecting others.* *To develop and apply communication and collaboration skills*
	5.1.3.Develop and apply learning to learn transferable skills	*To believe in one's and others' potential to continuously learn and progress.* *To be able to assess information and arguments to support reasoned conclusions and develop innovative solutions.* *To be able to plan, organize, monitor and review of one's own learning.*
5.2. Digital skills	5.2.1. *Develop and apply digital information and data literacy skills*	*To critically read and assess academic and professional communication related to Inclusive STEAM education in a range of media.* *To creatively produce academic and professional communication*

[7] *Transferable skills are skills learned in one context that are useful for another. They can serve as a bridge from study to work and from one career to another, as they enable subject and research-related skills to be applied and developed effectively in different work environments.*

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		related to Inclusive STEAM education in a range of media. *To participate in digital networks for learning and research in Inclusive STEAM education.* *To adapt and use digital devices applications and services related to STEAM education and Inclusion.* *To study and learn effusively in technology-rich environment, formal and informal.* *To participate in emerging academic professional and research Inclusive STEAM practices that depend on digital systems.* *To find, interpret, evaluate, manage and share digital information* *To use modern technologies to enhance and facilitate communication activities/projects.* *To continuously grow digital knowledge and skills whereby one finds, evaluates , uses and shares information using digital tools*
	5.2.2. Manage and use digital tools for communication and collaboration in Inclusive STEAM education	*To select and integrate appropriate digital tools based on the specific needs of their students and the learning objectives of their STEAM lessons.* *To understand of different digital tools and platforms that can be used for communication and collaboration in inclusive STEAM education, including video conferencing, collaborative document sharing, and project management tools* *To use digital tools to facilitate communication and collaboration among diverse groups of students.*
5.3. (Self) reflective and lifelong learning skills	5.3.1. Select and use(self)reflective practices and tools for Inclusive STEAM Education	*To collect, analyze, interpret data (learning outcomes, evaluation results, self-assessment) to improve Inclusive STEAM teaching/learning.* *To know, understand and be able to interpret and use the assessment results in order to improve the Inclusive STEAM related activities/projects.* *To reflect for self-improvement through personal learning in STEAM/Inclusion/Inclusive STEAM Education* *To reflect on one's own performance and respond to constructive criticism based on feedback from learners, other educators and supervisors in order to improve one's own performance* *To select and use appropriate self- assessment tools for Inclusive and STEAM Education (e.g.STEAM SAT tool, SELFIE for Teachers, TEIP for Inclusive Education)* *To participate in educational organization self-assessment procedures (via proper tools or other evaluation procedures) for assessing educational organizations' general and technical equipment in the aspects of sufficiency and suitability for Inclusive STEAM Education procedure.*

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	5.3.2. Participate in lifelong learning related to STEAM, Inclusion, and Inclusive STEAM educational approach	*To participate in continuous professional development in STEAM, Inclusion and Inclusive STEAM topics.* *To participate in various workshops, events, visit exhibitions etc. related to STEAM, Inclusion and Inclusive STEAM topics.* *To engage in personal, academic, occupational and professional growth through pursuing reflective study and research in STEAM, Inclusion and Inclusive STEAM areas*
	5.3.3. Apply action research procedures for reflection and improvement of educational procedures in Inclusive STEAM Education	*To monitor the latest developments and educational methods in STEAM, Inclusion and Inclusive STEAM.* *To find and read academic and professional texts related to STEAM, Inclusion and Inclusive STEAM education critically.* *To know, understand and use effective study methods*

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