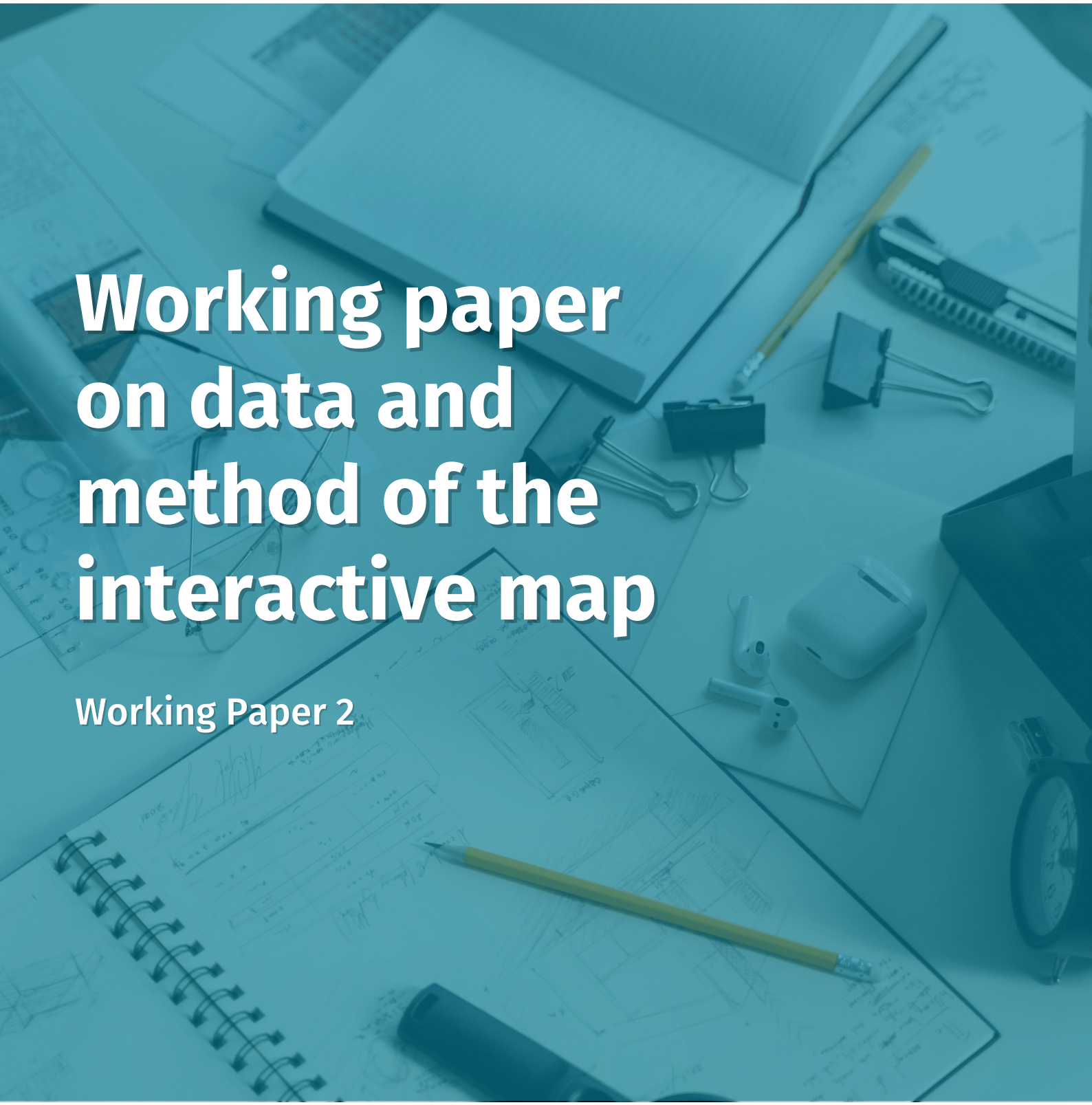
STRIDE
EDUCATIONAL POLICY FOR EQUITY & INCLUSION

Strategies for Achieving Equity and Inclusion in Education, Training and Learning in Democratic Europe (STRIDE)



Working paper on data and method of the interactive map

Working Paper 2

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Working paper on data and method of the STRIDE interactive map

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1. Introduction

This deliverable provides a comprehensive account of the development, methodology, technical specifications and functionalities of STRIDE's interactive map, produced in the course of WP4. Its purpose is to document the processes, design choices, and analytical procedures underlying the creation of an open tool intended to support evidence-based policymaking for equity, inclusion, and resilience in education. Moreover, the report explains how the interactive map compiles, visualises, and disseminates information on educational inequalities and policy reforms across Europe. In doing so, it positions the map as a central resource for researchers, practitioners, and policymakers, aligned with STRIDE's overarching objectives and complementary to outputs produced in other work packages, namely WP2 and WP3.

The specific aim of WP4 is to develop an interactive map that highlights factors influencing policy development and student achievement, with a view to supporting the understanding and monitoring of equity, inclusion, and resilience in education.

As a general objective, we aim for the map to become a valuable resource for researchers, policymakers, and stakeholders, offering insights into the impact of various factors on educational outcomes. To support this aim, we have aligned the development of the map with the project's agreed objectives and have incorporated feedback gathered through the international advisory board as well as discussions held in national stakeholder meetings. We also plan to integrate Google Analytics into the map to monitor usage patterns and assess its impact.

The specific objectives of STRIDE's interactive map are to:

- Highlight convergences and divergences among European countries regarding educational equity
- Provide users with quick and efficient access to relevant educational-inequality indicators and information on policy reforms
- Identify areas off target in cross-country comparisons and evaluate the impact of reforms
- Capture indicators related to inequality in education to inform policy decisions,
- Enable users to track the evolution of indicators over time
- Serve as a major source of information for researchers and stakeholders
- Offer downloadable information for further analysis and research

Thus, in general, users will have the ability to compare disparities between countries, download spreadsheets containing indicator values, and access country reports detailing education reforms and policy initiatives. Additionally, users will be able to track the evolution of each indicator over time, spanning from 1999 onwards. Descriptive statistics and graphs will be provided to enhance data visualisation and interpretation. These features will enhance understanding of educational disparities and support evidence-based policymaking efforts across Europe.

In summary, this deliverable brings together information on the data visualised in the interactive map, covering both policy reforms and inequality indicators, and details the methodology used to develop the map itself. It also establishes clear links with work carried out in other work packages, most notably WP2 and Deliverable 2.4 (Database of combined reforms), and WP3 and Deliverable 3.3 (Spreadsheet of key inequality indicators). More specifically, Section 2 outlines the methodology and technical specifications underpinning the development of both the indicators map and the policy reforms map. Section 3 provides an overview of the key functionalities of STRIDE's interactive maps, detailing how users can explore and navigate the available data. Finally, Section 4 explains the options of how the interactive map will be integrated within the STRIDE website.

2. Methodology and technical specifications

2.1. Methdology

The development of STRIDE's interactive map builds on earlier information visualisation paradigms in social research, such as the interactive map developed by the Erasmus University in Rotterdam, depicting the analysis of the total population, youth, migrants, and older individuals across 29 European countries, listing state-level data on two main aspects of labour market resilience: unemployment rate, and at-risk-of-poverty and social exclusion rate from 2007 to 2010. It also follows the logic behind EUROSTAT's Statistical Atlas[1], a map viewer where one can explore interactive maps for a range of different topics, such as population and census statistics, educational and health data, land use and land cover, etc. Moreover, it expands the expert knowledge produced during the development of DGmap (Symeonaki et al., 2022), the map developed for Horizon2020 DigiGen[2], an online interactive tool that visualises indicators drawn from large scale European and international databases reflecting use of Information and Communication Technologies (ICT) amongst children and young individuals in Europe. The features of the Mapineq were also considered, an interactive tool that was produced in the Mapineq project[3]. Furthermore, in the course of our work, we have thoroughly reviewed the Structural Reform support projects' interactive map[4]. This tool provided valuable insights into the presentation of information and inspired several ideas that we have considered and, where appropriate, integrated into the development of the approach in STRIDE's policy reform map. All these tools provided important reference points for best practices in map-based visualisation, structuring metadata, and enabling user-driven exploration. However, STRIDE's map advances this landscape in several ways. First, it introduces two complementary but distinct interfaces, one for harmonised educational-inequality indicators and one for systematically coded national educational policy reforms, addressing an important gap, as to our knowledge no existing interactive maps provide comparable coverage of either educational inequalities or national education-policy reforms individually.

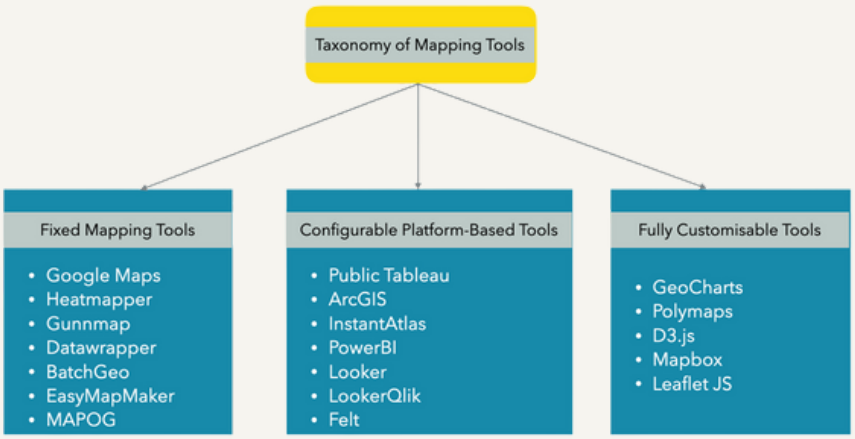
1. Available at: https://ec.europa.eu/statistical-atlas/viewer/
2. https://digigen.eu/
3. Mapping inequalities through the life course, available at https://mapineq.eu. The project studies the trends and drivers of intergenerational, educational, labour market and health inequalities over the life course during the last decades, and distinguishes between local, regional, national and supranational levels.
4. Available at: https://reform-support.ec.europa.eu/our-projects/projects-interactive-map_en

Second, unlike earlier tools that typically focus on a single data domain, STRIDE's map integrates quantitative indicators with qualitative policy metadata, enriching both forms of information and supporting more nuanced interpretation. Third, STRIDE's map incorporates features not commonly available in previous platforms, including tailored downloadable country profiles, consistent cross-country comparison tools, and a technical framework that supports ongoing expansion and interoperability.

Methodologically speaking, Few (2013) offers a useful taxonomy for information dashboards, categorising them into three main types: strategic, operational, and analytical. Both the inequality indicators' map, and the policy reforms' map support analysis across these three complementary categories. At the strategic level, the maps offer a clear visual overview that enables users to compare countries, highlighting key inequality indicators alongside the number and focus of policy reforms. At the operational level, both maps incorporate longitudinal elements, allowing users to monitor changes in indicators and reform activity over time. At the analytical level, users have access to downloadable datasets (in Excel format) and country reports, facilitating more detailed examination of relationships between policy reforms, inequality indicators, and temporal trends across countries. The visualisation was updated with input from experts, consideration of user and stakeholder needs, and recommendations from consortium members and members of the international advisory board at consortium meetings. Adjustments to the functionalities, design, and layout were made accordingly.

Now, with the increasing availability of ready-made systems for visualising data, a thorough investigation was deemed necessary. These visualisation systems can be grouped into three categories according to the level of freedom they offer when designing and customising the visual output. In Figure 1 we illustrate an outline of the taxonomy of existing mapping tools that are appropriate for the scope of STRIDE's interactive map.

Figure 1. Taxonomy of existing mapping tools relevant to STRIDE's map, grouped according to the degree of freedom they offer in designing and customising visual outputs



The first category, Fixed Mapping Tools, includes platforms that offer only minimal flexibility, providing a small set of predefined options and allowing little to no modification beyond basic data display. These tools are typically used for very simple visualisations, such as presenting a single indicator (Romero, 2019), and are designed primarily for quick, basic display rather than advanced exploration. This method involves uploading structured files (e.g., CSV or XLSX) to a platform that handles the visualisation and provides a shareable public URL.

Examples of such tools include Google Maps[5], Heatmapper[6], Gunnmap[7], Datawrapper[8], BatchGeo[9], EasyMapMaker[10] and MAPOG[11]. These tools allow non-specialists to create simple, informative maps easily. However, they offer limited customisation in terms of type, colour, and map functionalities, often not allowing the addition of menus, extra pages, or logos. Additionally, maps created with these tools can become inaccessible if the platform goes offline, as is the case with OpenHeatMap. Ultimately, these tools are intended to offer users quick and accessible insight into a given dataset through a simple map interface, rather than to serve the needs of a purpose-built software solution developed for this project.

The second category, Configurable Platform-Based Tools, consists of platforms that provide an intermediate level of flexibility, offering significantly more configuration options and built-in functionalities than the tools included in the first. They come with a broader set of predefined capabilities that support more comprehensive forms of analysis. These systems enable users to carry out a wider range of operations, apply richer analytical filters, and combine multiple datasets, although their extensibility is still shaped by the functions exposed through the user interface. Additionally, they provide advanced functionalities, such as loading multiple map datasets simultaneously or selecting specific areas or countries for display. However, customisation of the map's environment is often limited. Examples of tools that fall within this group include, among others, Public Tableau[12], ArcGIS[13], InstantAtlas[14], PowerBI[15], Looker[16], LookerQlik[17], and Felt[18].

5. https://www.google.com/maps
6. http://heatmapper.ca/
7. https://lert.co.nz/map/
8. https://www.datawrapper.de/
9. https://www.batchgeo.com/
10. https://www.easymapmaker.com/
11. https://www.mapog.com/
12. https://public.tableau.com/app
13. https://www.arcgis.com/index.html
14. https://www.esriuk.com/
15. https://app.powerbi.com/
16. https://lookerstudio.google.com
17. https://help.qlik.com/en-US/
18. https://felt.com/

Since these platforms offer more extensive functionality, they typically require users to undergo more substantial training in order to fully utilise their capabilities. However, despite their enhanced feature set, certain operations remain unsupported, such as performing fully custom geospatial interactions, embedding user-defined logic directly into the map's interface, or altering the underlying rendering pipeline. These platforms also limit the ability to implement bespoke workflows that depend on dynamic event handling, real-time data streams, or programmatic manipulation of map layers beyond what the interface explicitly allows.

The third category, Fully Customisable Tools, comprises tools that offer the highest degree of flexibility, enabling extensive control over both the map's configuration and its surrounding environment. Unlike the first two groups, which rely primarily on predefined functionalities exposed through a graphical interface, this category is based on integrating the map directly into a custom-built web application. In this approach, a web page communicates with a third-party mapping service or library, sends data to an application layer, and receives a dynamically generated map instance in return. The map is then embedded and displayed without restrictions, allowing full freedom over layout, styling, interactivity, and overall user experience.

This level of versatility requires programming expertise, as it involves writing and maintaining code rather than relying on a visual editor. Instead of working within the constraints of predefined interface options, developers can embed the map into a custom web environment and shape how it behaves as part of a broader application.

This allows the visualisation to interact seamlessly with other components of the system, such as search modules, user authentication layers, or application-specific workflows, and to adopt any layout or navigation structure required by the project. The map thus becomes one element within a fully configurable interface, rather than a fixed component constrained by a platform's predefined layout or tools. Consequently, this category is particularly suitable when the visualisation must operate as an integrated part of a custom-built solution, aligning both its functionality and its appearance with the unique objectives of the hosting application.
Examples of tools in this third group include GeoCharts,[19] Polymaps,[20] D3.js,[21] Mapbox,[22] and Leaflet JS,[23] all of which are widely used in academic and professional contexts (Worldometer, 2020; Zeng et al., 2019). Unlike ready-made visualisation platforms, these libraries allow

19. https://developers.google.com/chart/interactive/docs/gallery/geochart
20. http://polymaps.org/
21. https://d3js.org/
22. https://www.mapbox.com
23. https://leafletjs.com/

developers to build purpose-specific solutions and to integrate the map seamlessly into a broader software ecosystem, making them the most powerful, and simultaneously the most demanding option from a programming perspective, within the spectrum of available mapping technologies.

Given the project's need to integrate external libraries, dynamically request data from the backend, and combine the map with custom functionalities such as API-driven updates, dynamic charts, downloadable spreadsheets, and user-defined interactions, we adopted the third approach. Tools from the first two categories, such as Google Maps and Public Tableau, were initially considered but ultimately rejected due to their limited customisation options. It is important to note here that none of the tools in the first or second category provide the breadth of functionalities or the level of customisation offered by STRIDE's map. In the third category, the map is integrated within a custom web environment, allowing the remaining functionalities to be designed and developed around it. Accordingly, a code-based solution was selected, and Leaflet JS was used to embed and manage the map component, while the surrounding interface and additional tools were implemented as part of the broader application.

Leaflet JS is widely used and well-regarded for its flexibility and advanced features. The decision to build STRIDE's map with a lightweight, open-source framework such as Leaflet reflects a careful balance across several technical criteria essential for a robust and future-proof platform. Its high level of flexibility and customisation allows full control over the interface, e.g., menus, legends, filters, and map behaviours, ensuring that the user experience can be tailored to the needs of diverse audiences rather than constrained by fixed templates. In terms of integration and extensibility, the framework supports seamless connectivity with external libraries (e.g., D3.js, Chart.js) and APIs, enabling the development of dynamic visualisations, downloadable country profiles, and automated data updates. From a performance perspective, it remains lightweight and fast to load, an advantage when compared with larger proprietary environments. The overall user experience benefits from responsive, device-independent interactions, while still allowing the project team to refine visual quality and navigation flow based on feedback. The choice also leverages a strong community and support ecosystem, offering extensive documentation and frequent updates, even if formal vendor support is not provided. Finally, its licensing and cost advantages, being free, open-source, and permissively licensed, ensure long-term sustainability and avoid dependency on costly commercial software. Table 1 summarises the main advantages and limitations of Leaflet JS, explaining the rationale for its selection compared to alternative mapping frameworks.

Table 1. Advantages and limitations of Leaflet JS for STRIDE's interactive maps

Criterion	Advantages	Limitations
Flexibility and Customisation	Highly flexible and open-source; allows full control over layout, menus, legends, and map environment.	Requires web development expertise (HTML, JavaScript, CSS).
Integration and Extensibility	Easily integrates with external libraries (e.g., D3.js, Chart.js) and APIs for dynamic charts, reports, and downloads.	Custom integrations may require additional programming and maintenance.
Performance	Lightweight and fast to load compared to larger frameworks (e.g., ArcGIS or Tableau).	May need optimisation for very large datasets or complex layers.
User Experience	Supports interactive and responsive visualisations across devices.	Lacks built-in templates, visual quality depends on developer implementation.
Community and Support	Large open-source community, frequent updates, and extensive documentation.	No formal technical support or warranty (community-based troubleshooting).
Licensing and Cost	Free, open-source, and permissive (BSD 2-Clause license).	Some third-party plugins may have separate licenses or dependencies.

Although Leaflet JS has some requirements, such as web development skills, optional code for custom integrations, and occasional optimisation for large datasets, these are well within the team's technical capacity and are common considerations for advanced mapping tools. Its lack of built-in templates simply provides greater design freedom, and although support is community-based, Leaflet benefits from an active and well-documented developer ecosystem. Any plugin-specific licences or dependencies are easily managed. Thus, these limitations are minor and do not hinder the effective implementation of STRIDE's maps.

As already mentioned, two maps are required: one focusing on policy reforms and the other on inequality indicators. This was achieved by developing a primary map and subsequently creating a duplicate, which was then adapted to meet the specific requirements of the second purpose.

For the indicators' map, data is visualised in line with the seven stages presented in Fry (2008), i.e., acquire, parse, filter, mine, represent, refine, and interact. Figure 2 depicts the stages summarised in Fry (2008) and the analogous suggested steps to be followed while developing the indicators' map. Data representation (5th stage) is implemented on Fry's (2008), Sedrakyan's, et al. (2019) and Schultz's (2018) recommendations for visualising and communicating data in a clear, concise, and complete manner.

Figure 2. Stages of data visualisation and respective steps followed while developing STRIDE's indicators' map

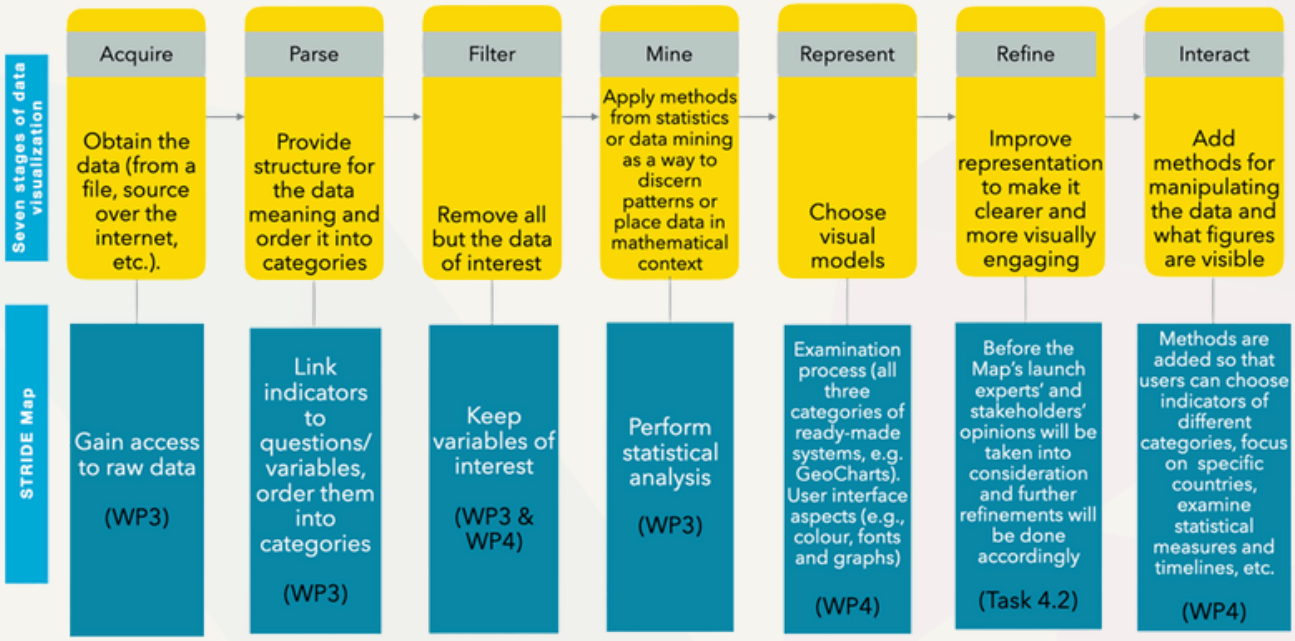


Figure 2 therefore depicts these stages and the respective steps that were followed:

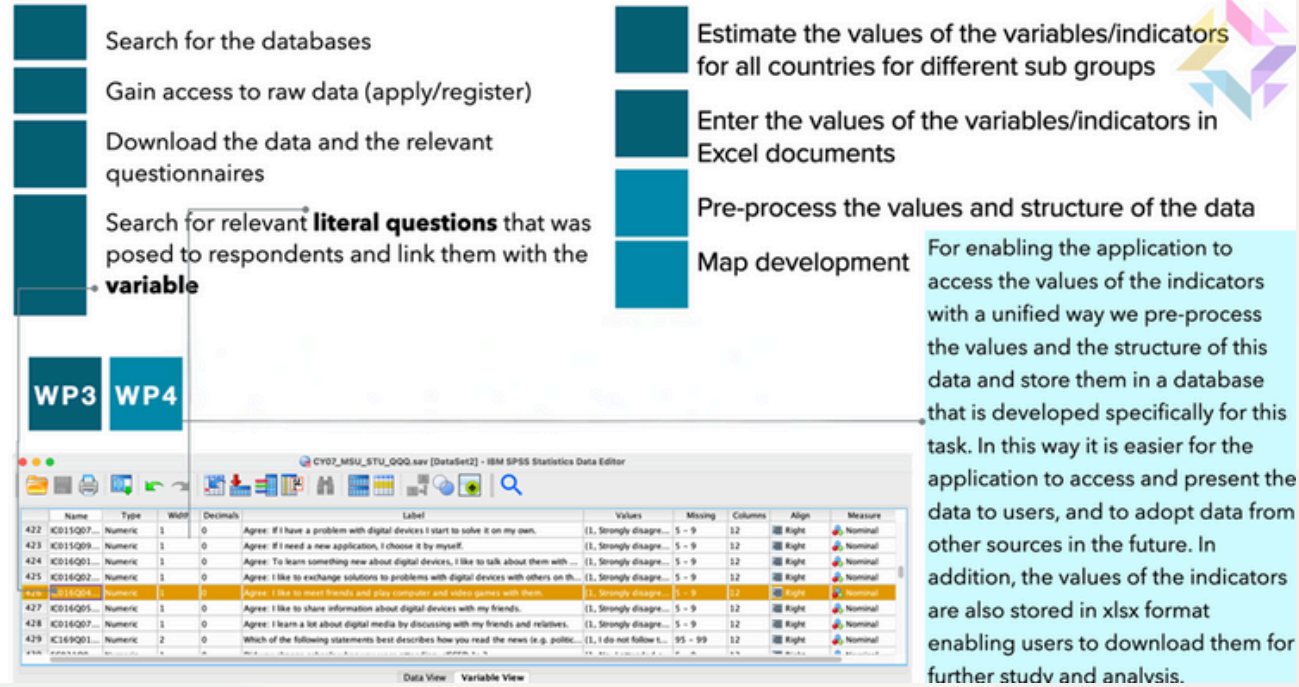
- Access to raw data (WP3)
- Linking indicators to questions found in the questionnaires of the respective data surveys (WP3)
- Narrow down to those variables that are of interest (WP3 and 4)
- Perform statistical analysis, e.g., descriptive statistics (WP3 and 4)
- Examine the possibilities of ready-made systems which resulted in Leaflet JS as the best solution for developing the map (WP4)
- Improvements and refinements were implemented to make the representation visually engaging (Task 4.2, WP4)
- Interaction methods were added so that users can chose indicators of different categories, focus on specific countries, examine statistical measures and graphs, etc. (WP4).

Figure 3 describes the steps of the procedure followed for the estimation of the indicators, starting from the systematic review of available databases, i.e., large-scale social surveys' datasets that could contain relevant information, and ending with the upload of the indicator's values on the map. Apparently, the initial step was to review the availability of relevant data sources in WP3. The identification of the databases, i.e., finding which datasets are relevant, is followed by gaining access to raw data and downloading the data in a statistical analysable form (e.g., in SPSS) together with the relevant questionnaires that were distributed to respondents during the respective survey.[24] Searching for the exact questions that were posed and linking them with specific variables is the subsequent phase. Estimating the values of the indicators involves not only basic descriptive statistics, but also more advanced statistical procedures to transform, filter, or otherwise process the data in order to obtain reliable estimates or approximations. All data were weighted following the official weighting procedures specified in each source database (e.g., PISA, ICILS, TIMMS), ensuring that all estimates are representative of the target populations. Having estimated the values leads to the next step of importing the data from the spreadsheet documents. We then pre-process the values and the structure of the data. This is necessary for enabling the application to access the values of the indicators with a unified way, storing the values in a database that was developed especially for this task.

24. Included surveys:
- PISA: Programme for International Student Assessment
- ICCS: International Civic and Citizenship Education Study
- TIMSS: Trends in International Mathematics and Science Study
- PIRLS: Progress in International Reading Literacy Study

Pre-processing involves cleaning the raw datasets, removing unnecessary or inconsistent entries, harmonising variable formats, and restructuring the information so that it aligns with the database's required schema. It is then simpler for the map to access and display the indicators to users, but also easier to adopt data from other sources in the future. Moreover, the indicators' values are stored as Excel files to enable users to download them for further research directly from the map.

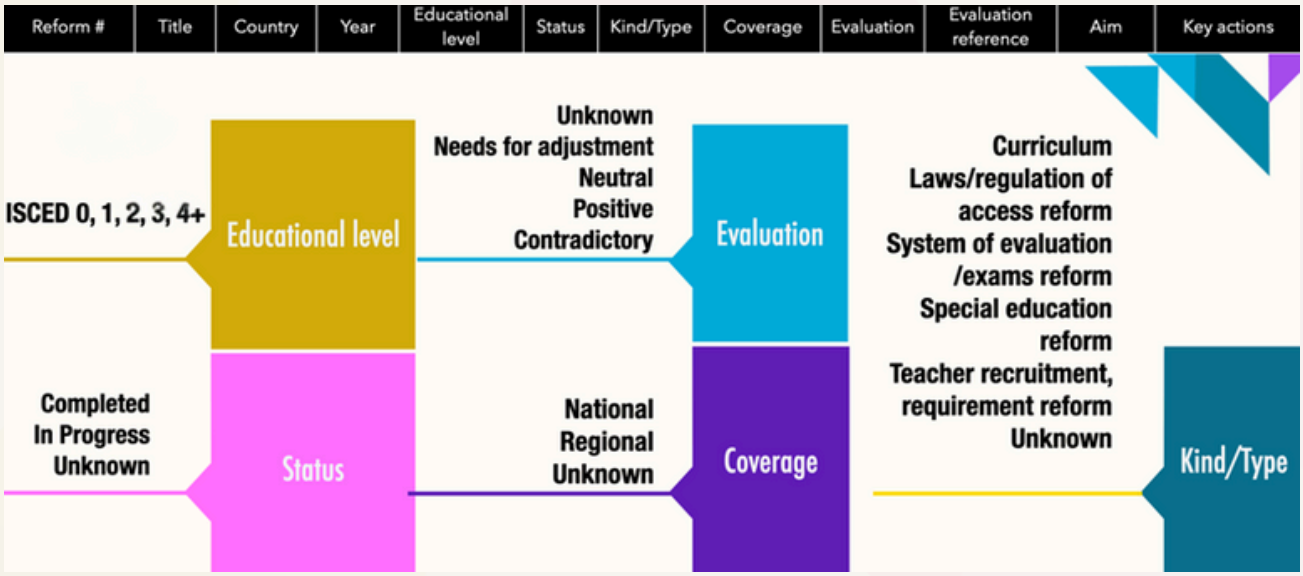
Figure 3. Workflow of the procedure for estimating the indicators, beginning with the review of relevant databases (WP3) and concluding with the upload of indicator values to the interactive map (WP4)



The **policy reforms**' map visualises the most important educational reforms in European countries over the last 25 years that address the problem of inequality in education as identified in WP2. In terms of depicting these policies on the map, particularly to enable cross-country comparisons, we relied on the detailed spreadsheet of policy reforms produced in WP2. STRIDE's map currently displays 431 reforms implemented between 1999 and 2024 across 29 countries (including EU Member States, England, and Norway). This database includes key information for each reform, such as (Figure 4):

- Title, country, and year of implementation
- Educational level affected
- Status
- Type or category of reform
- Coverage
- Evaluation outcomes
- Stated aim and key actions of the reform.

Figure 4. Key information included in the policy reforms database used for the visualisation



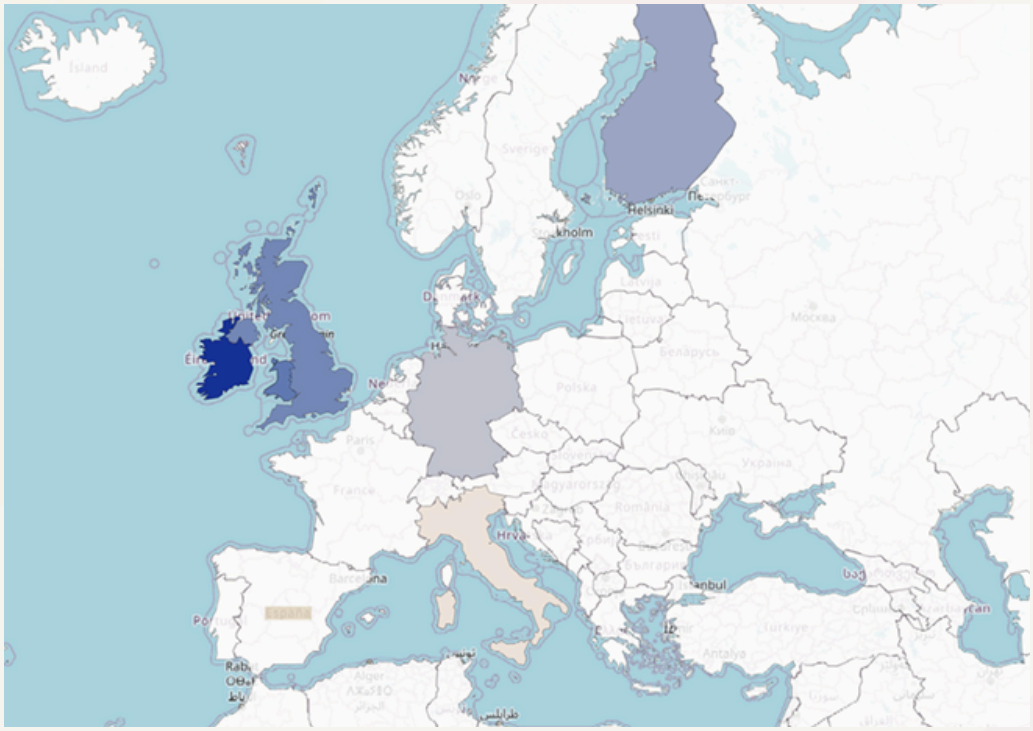
2.2. Technical Specifications

The application is divided into two main parts, the frontend and the backend, which work together seamlessly to ensure effective map performance. The frontend is the part of the application that users interact with directly. It includes the page's appearance and browser functionalities, such as button designs, map appearance, and autocomplete suggestions. The STRIDE's map user interface is built using HTML5, CSS3, and JavaScript. For responsive and sophisticated graphs, Bootstrap v.4.0, an open-source package is used, providing numerous chart options and customization capabilities. The client-side functionality utilises jQuery v.3.5.1, a feature-rich JavaScript library that simplifies HTML document traversal, event handling, animation, and Ajax.

For map development, STRIDE's map uses Leaflet JS library. As already mentioned, Leaflet JS is an open-source JavaScript library, which excels in creating mobile-friendly interactive maps, offering extensive control over map behaviour and appearance through numerous plugins and a straightforward API. Unlike GeoCharts, the initial library used for map development, which can be limited in terms of customisation and interactivity, Leaflet JS supports various map layers, markers, and popups, enabling a more tailored and dynamic user experience. Additionally, Leaflet JS is designed to handle a wide range of map data formats, ensuring seamless integration with various data sources and enhancing its versatility for diverse applications. Furthermore, it allows the embedding of custom maps with specific borders, which is crucial for tasks such as **outlining the UK countries**, which was a significant challenge since most ready-made libraries do not provide separate borders for these countries; instead, they present the UK as a single entity.

This challenge was addressed by manually delineating the countries of the UK, as illustrated in Figure 5, using specific geographical coordinates and then utilising Leaflet JS to load and display the custom map. JavaScript and jQuery facilitate map reloading without reloading the entire page.

Figure 5. Outlining the UK countries



Charts are developed using Chart.js [25] v.3.6.0, which provides predefined functions for graph depiction. Asynchronous JavaScript and XML (AJAX) technology was used to update the map asynchronously by exchanging data with the server in the background, allowing updates to parts of the web page without reloading the whole page.

25. https://www.chartjs.org/

For the backend, we used Python v.3.8.8, an open-source general-purpose programming language. To transform the local application into an online microservice, we utilise the Flask[26] v.2.0.1 module along with Gunicorn[27] v.20.1.0. The map also leverages several Python libraries for server-side functionality, including NumPy,[28] which supports large, multi-dimensional arrays and matrices and offers a wide range of high-level mathematical functions, and Matplotlib,[29] a plotting library for Python and NumPy. More specifically, for loading new indicators into the map and exporting data to spreadsheets, Python libraries such as Pandas[30] and Openpyxl[31] were utilised due to their robust data manipulation and Excel file handling capabilities. For enhanced efficiency, the data pertaining to the indicators are chosen to be exported from Excel files and stored in a structure optimised for the platform's performance. This approach facilitates the platform's ability to load and display the information more swiftly and with greater ease. To store the indicators in this optimised structure, the Pickle and Pandas libraries are utilised. Additionally, the creation of PDF reports is facilitated by the Pillow library, which is well-suited for image processing tasks essential in generating high-quality visual content for the reports.

Notably, STRIDE's map will be freely accessible to users without the need for registration or login. SSL encryption will ensure privacy, authentication, and data reliability on the platform. Additionally, the map's performance will be tested across multiple browsers (Google Chrome, Safari, Mozilla Firefox, and Microsoft Edge) and operating systems (MacOS, Microsoft Windows, Android, and various Linux distributions) to ensure smooth operation.

26. https://flask.palletsprojects.com/en/stable/
27. https://gunicorn.org/
28. https://numpy.org/
29. https://matplotlib.org/
30. https://pandas.pydata.org/
31. https://openpyxl.readthedocs.io/en/stable/

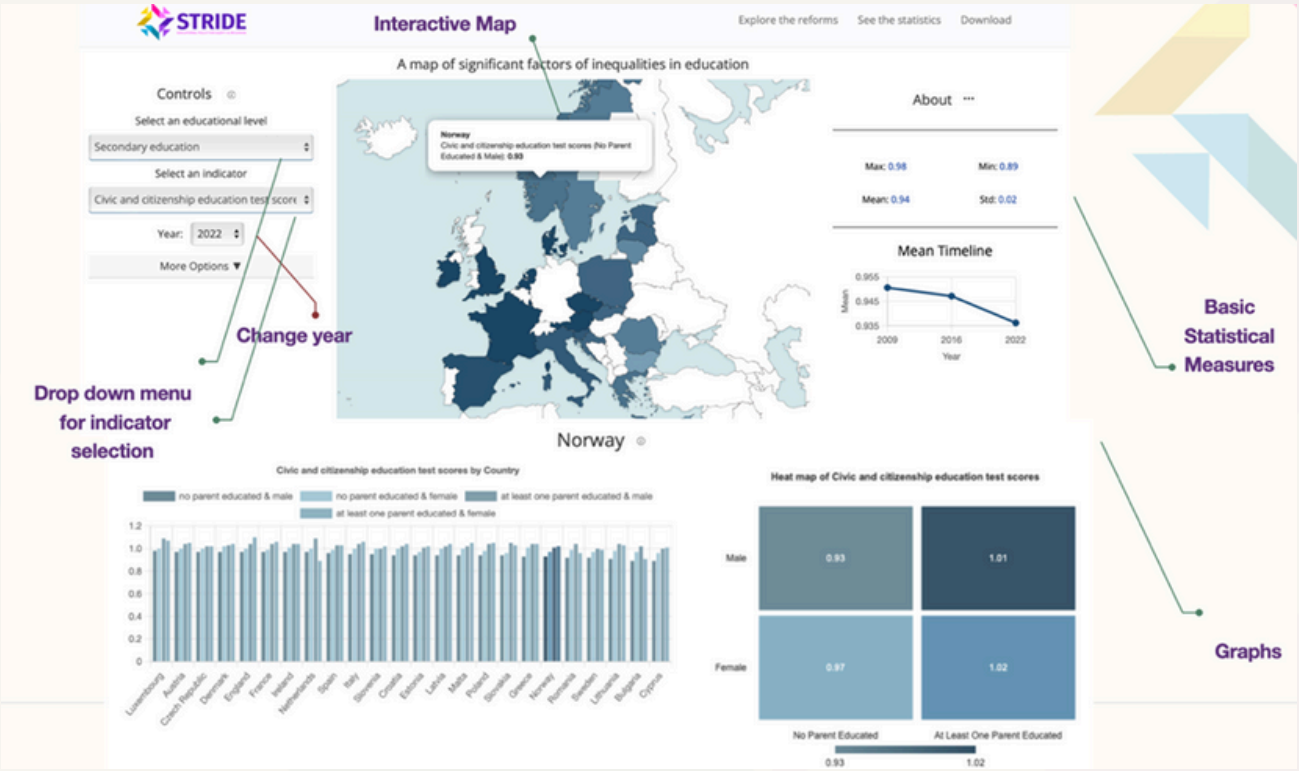
3. Overview of the key functionalities of STRIDE's interactive map

3.1. Key functionalities of the inequality indicators map

This section presents the key features and functionalities of the STRIDE inequality indicators' map frontend. At this part, our primary objective is to develop an online interactive map that visualises the inequality indicators estimated in WP3. By clicking on 'Explore the indicators', users are redirected to this environment, while selecting 'Explore the reforms' from the menu allows them to view the policy reforms map.

In the indicators' interface, the map offers interactive options that help users examine the indicators across different thematic categories and subcategories. Figure 6 illustrates the main operations of this part of the application.

Figure 6. The interactive map of indicators and its main functionalities: indicator selection, graphical and statistical information, indicator details, and downloadable files



A clear and well-structured categorisation of indicators is essential for ensuring that users can easily navigate the map and select the information they need. It is crucial, therefore, to categorise indicators in a way that enhances their selection process. To facilitate how users select the indicator they wish to view on the map, we are using dropdown menus, that are dynamically updated based on the selected indicator. This is necessary because different indicators have different categorisations. The first level of filtering available to users is the educational level the indicator belongs to, which helps narrow down relevant options. The current categories are Pre-school, Primary education, and Secondary education. Using dropdown menus is more effective because it displays only the available options, avoiding confusion caused by showing unavailable or unsupported by the data selections. Figure 7 exhibits the way the indicators are filtered.

Figure 7. Filtering the indicators

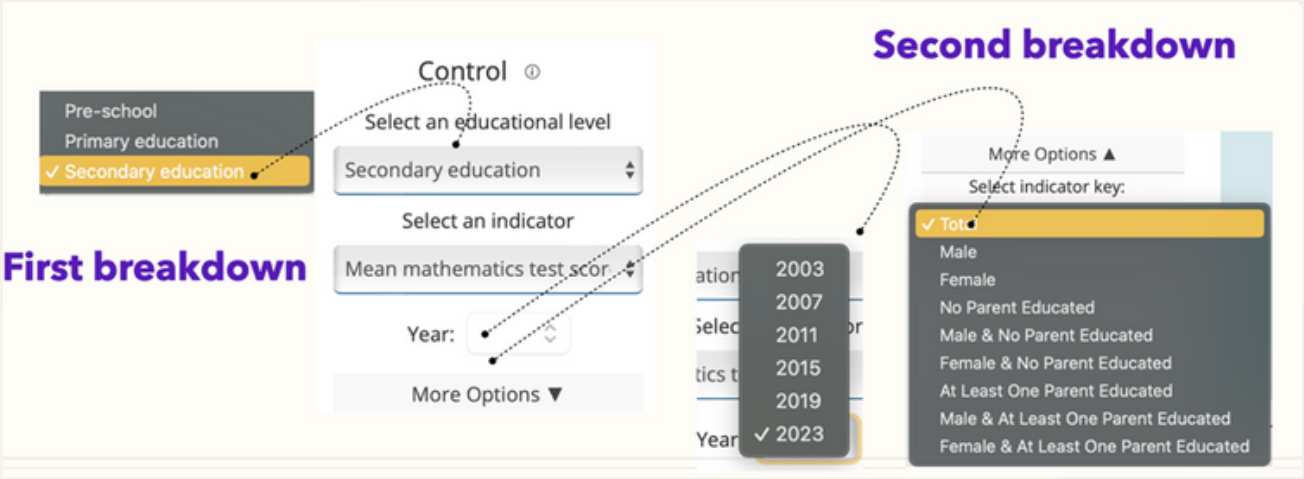
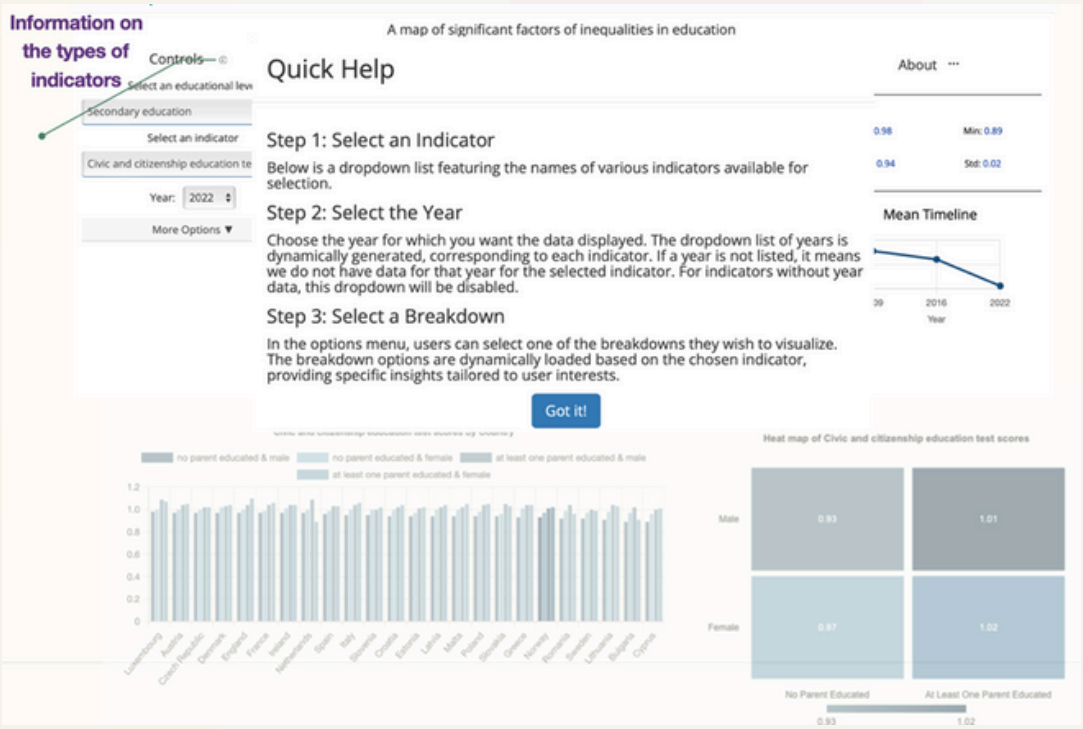


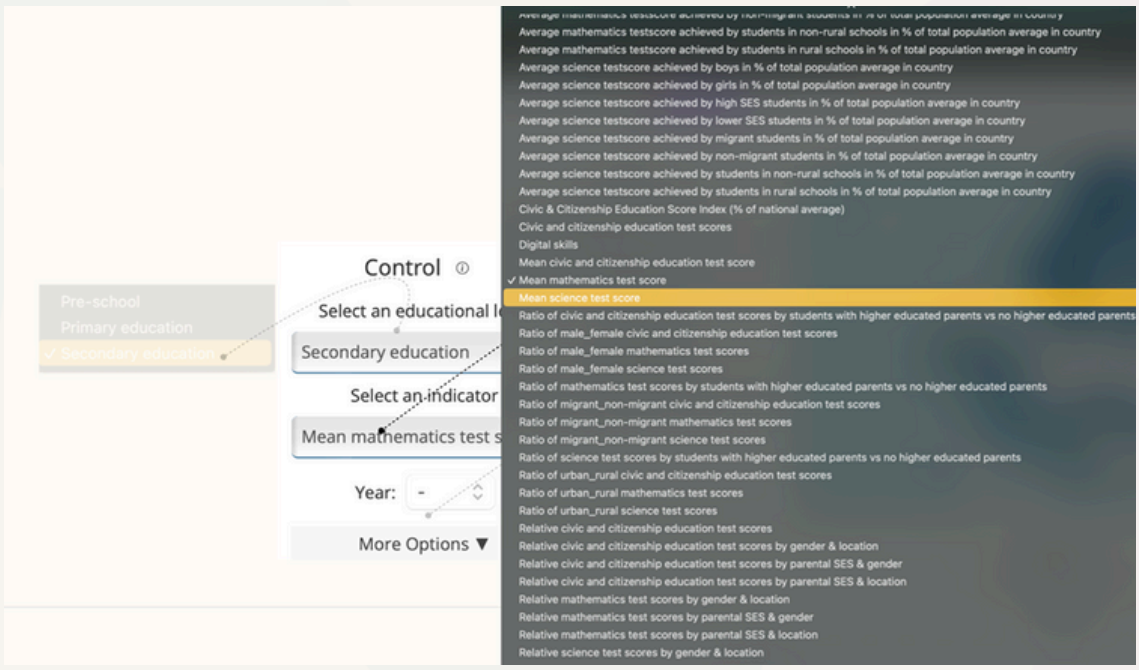
Figure 8 presents the Quick Help feature, which appears when users click on the information button next to Control. Selecting 'Got it' allows them to resume navigation.

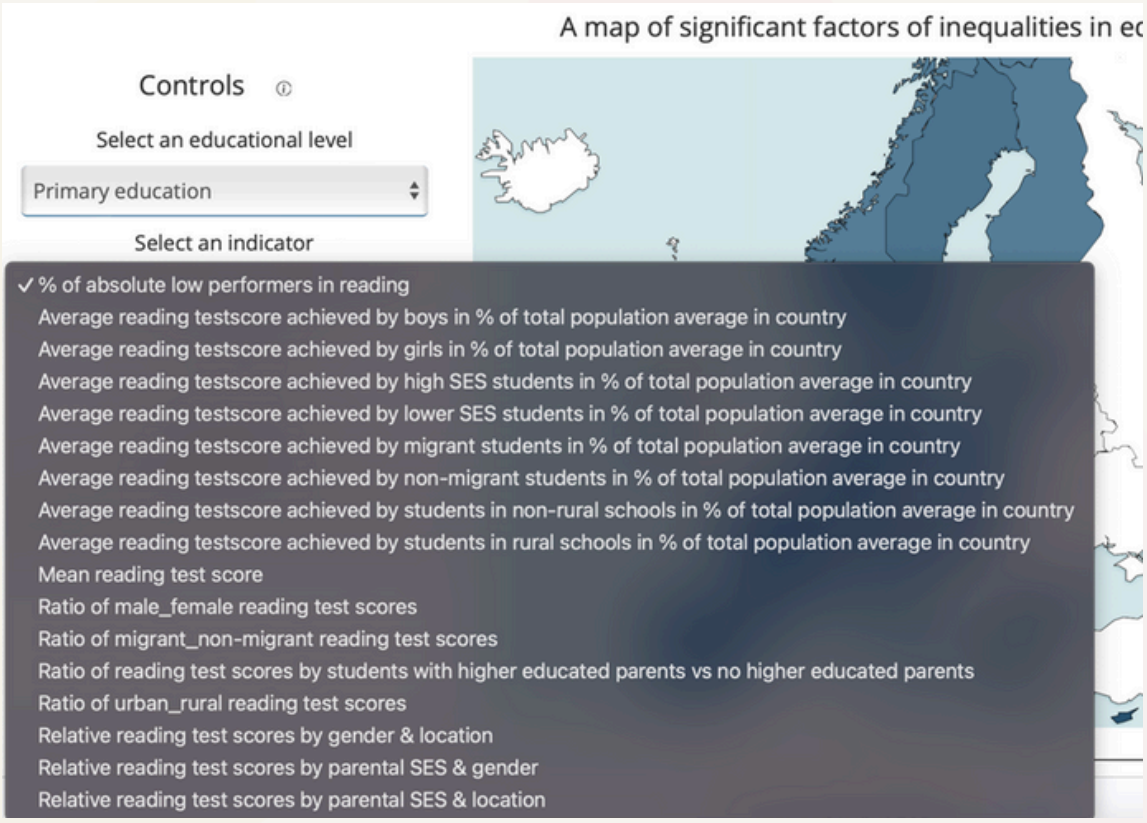
Figure 8. Quick Help pop-up accessible via the information button



At this stage, all indicators from WP3 spreadsheet are available for selection (Figure 9). To improve user experience when browsing the large number of indicators available, the map now includes an enhanced navigation feature. Users can begin typing to automatically jump to the matching indicator, for example, typing “civ” takes the user directly to “Civic…”. Although the typed letters are not visible on screen (as the function operates in the background), this greatly facilitates faster access to specific indicators.

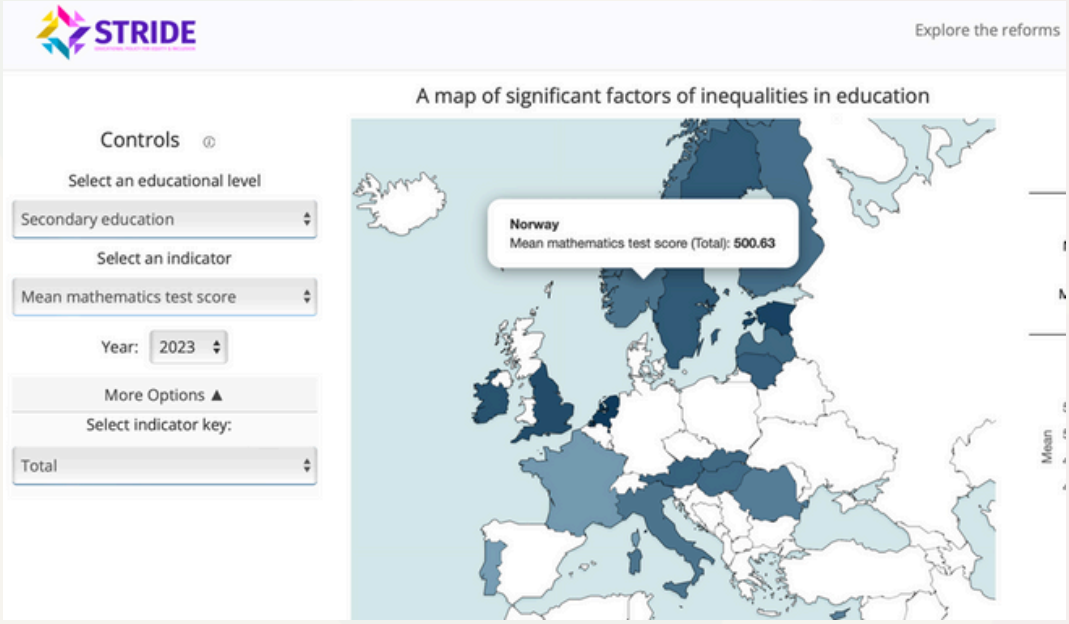
Figure 9. Available indicators (primary and secondary education)





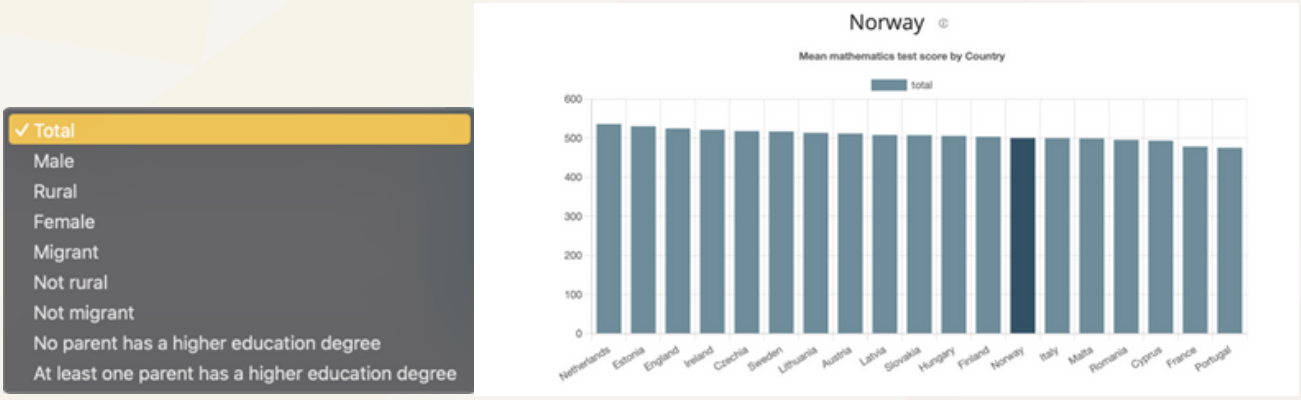
Upon selecting the indicators, the corresponding map will be automatically generated, classifying European countries based on their indicator values. The intensity of colour on the map increases with higher indicator values (Figure 10). By using only the initial filter, here secondary education, and for example, selecting “Mean mathematics test score”, and without activating the additional breakdown options, the map will display disparities in mathematics performance across countries for the total sample.

Figure 10. Visualising European countries by indicator values, with darker shades representing higher values



Users can hover over countries to view the indicator's value for each one. Clicking on a country highlights it, displaying its position on the bar chart. This feature allows users to precisely determine where the selected country stands in comparison to others (Figure 11).

Figure 11. Country selection functionality highlighting the chosen country and displaying its position on the bar chart



If the user selects any of the other four categories, the map displays the corresponding bar chart and heatmap for the selected country (Figure 12). Users can click on any option to adjust the graph's appearance according to their preferred visualisation (Figure 13).

Figure 12. Visualisations generated according to the selected category, including the corresponding bar chart and heatmap for the chosen country

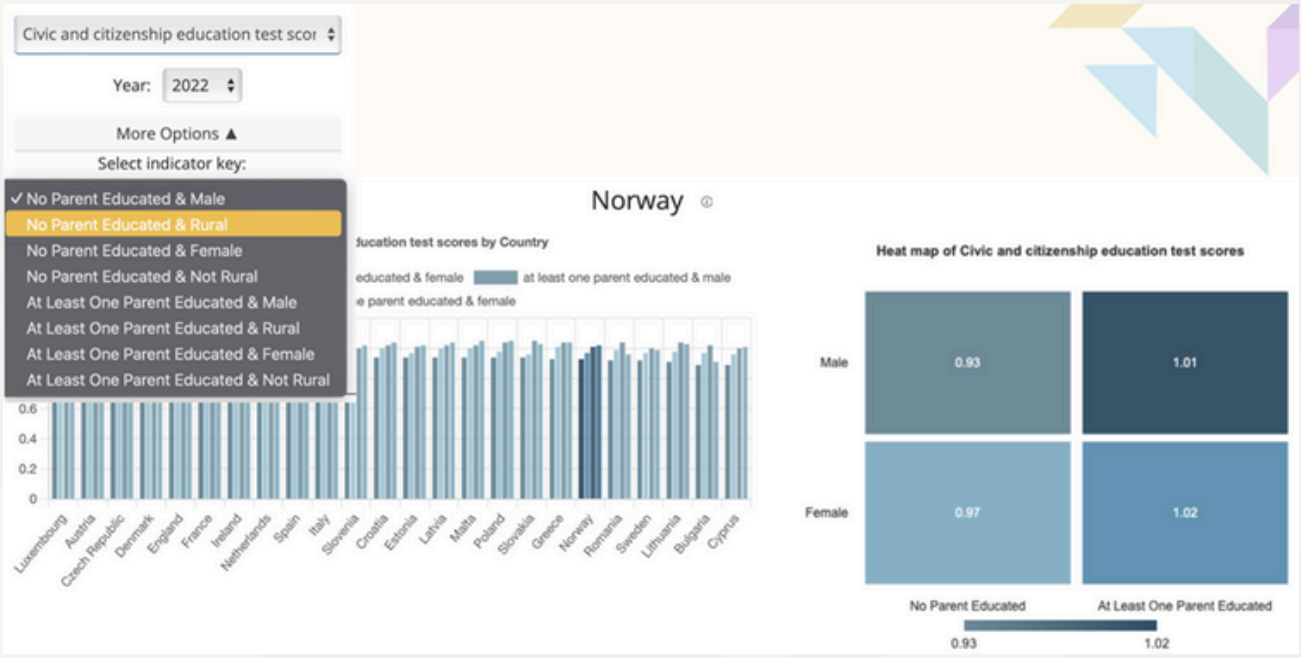
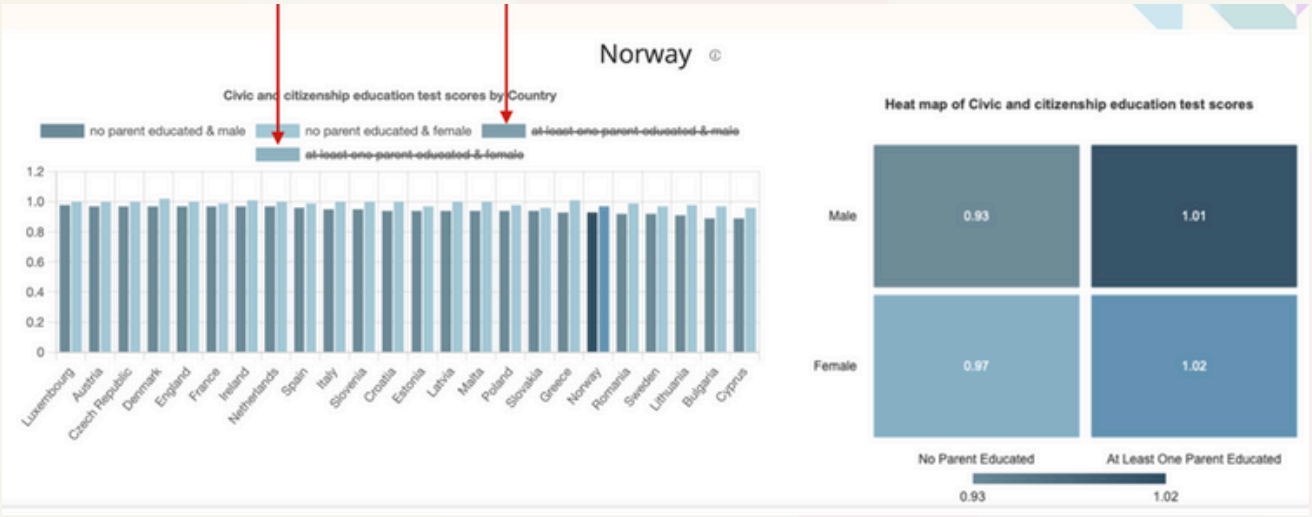
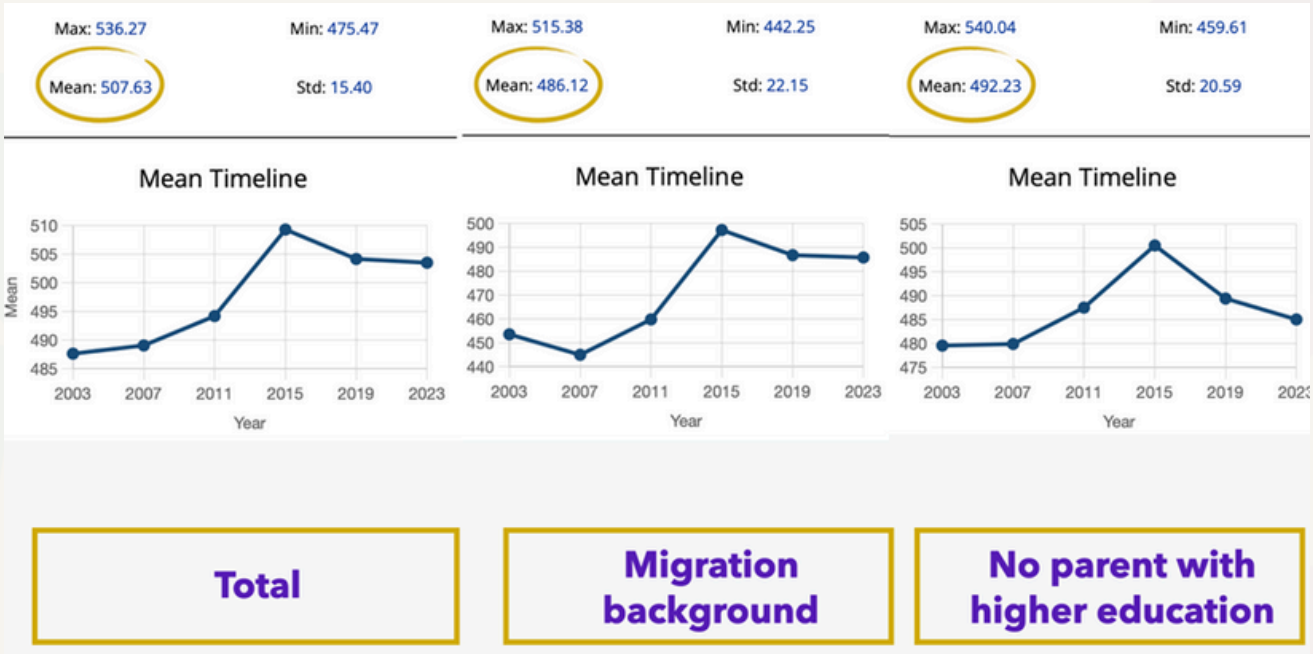


Figure 13. Graph customisation options



Basic descriptive statistical measures are also provided, including the minimum and maximum values, the mean value across all countries, and the standard deviation. Users can navigate to the graph section either by scrolling down or by clicking “See the Statistics”. The graphs illustrate the indicator’s values across all countries, with the selected country highlighted in dark blue. For indicators with available time series data, users can examine the evolution of values over time (Figure 14).

Figure 14. Evolution of mean mathematics scores over time, including total averages and breakdowns by students with a migration background and parental education level



Selecting 'Download' enables users to export the values of the selected indicator in Excel format. Additional information related to the selected indicator is accessible to assist users, including social researchers, academics, policymakers, and the general public, in understanding the indicator's specifics. Clicking the "About..." button provides detailed documentation for each indicator, potentially covering:

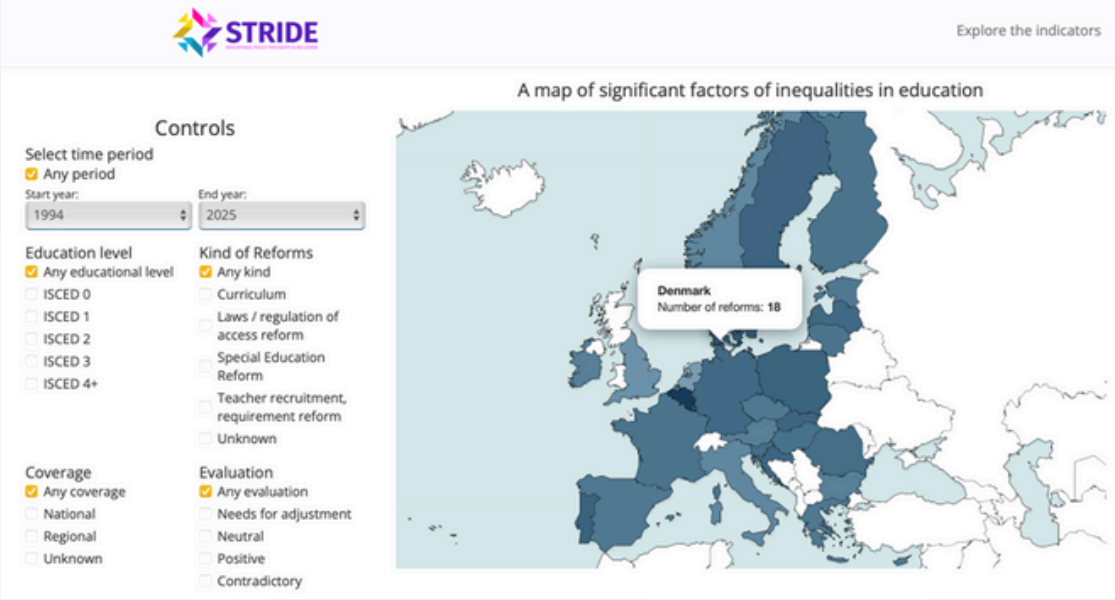
- The indicator's definition, specifying what it measures
- The dataset used for estimation
- The variables involved and the methodology used for evaluation
- The survey question posed to respondents
- The variable values or categories available for respondents to choose from.

3.2. Key functionalities of the policy reforms map

STRIDE's map allows users to visualise the policy reforms map by clicking on 'Explore the reforms' on the main menu. The frontend of the reforms' map is shown in Figure 15. Users can filter the map display based on multiple criteria, including the year (or any year), educational level (or all levels), evaluation outcome, and other attributes. This functionality enables users to explore the number of reforms implemented in each country based on their selected filters.

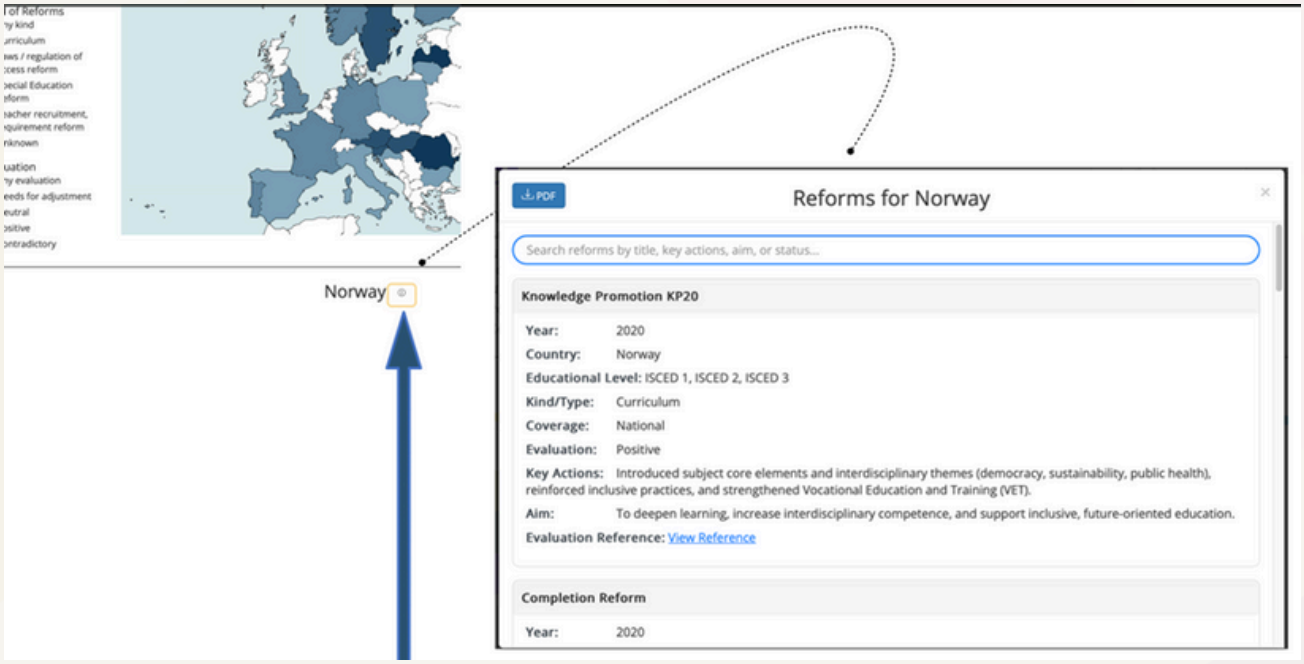
When hovering over a country, the interface displays the number of reforms corresponding to the chosen criteria. For instance, selecting Denmark with any time period and policy reform type reveals the number of reforms (18) that meet the specified conditions (Figure 15).

Figure 15. The fronted of the education policy reforms' map



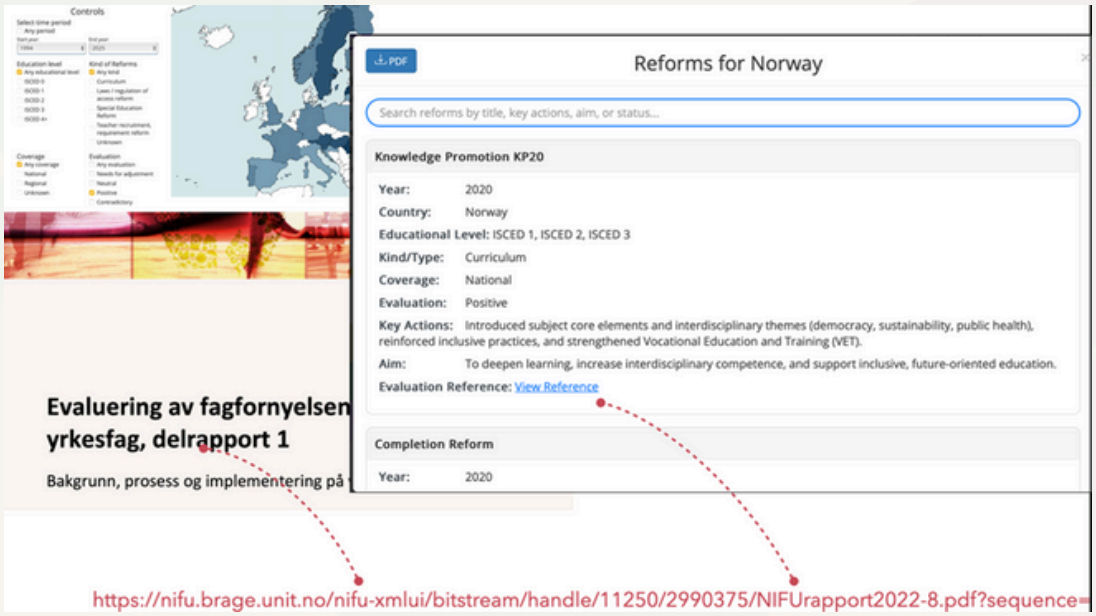
Users can select the 'Positive evaluation' option to view reforms that may serve as examples of best practice. Moreover, users can click on a country, and then the information icon, and that will bring up further details on the reforms for that country (Figure 16). That includes the title of the reform, year, educational level, its aim, and the key actions associated with it. Users can scroll down to see all the reforms, use the search functionality to find specific reforms or view the evaluation reference by clicking on the link.

Figure 16. Summary of country specific education policy reforms



By selecting the link, users can view further information, specifically the evaluation report related to the reform (Figure 17).

Figure 17. Evaluation reports for education policy reforms a) Norway b) UK



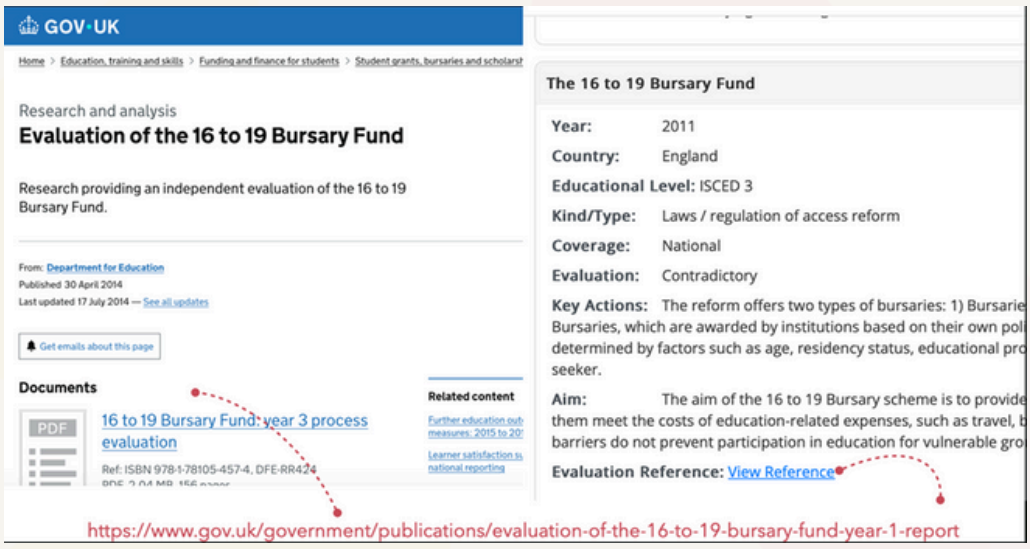


Figure 18. Download options enabling users to obtain a PDF summary of reforms

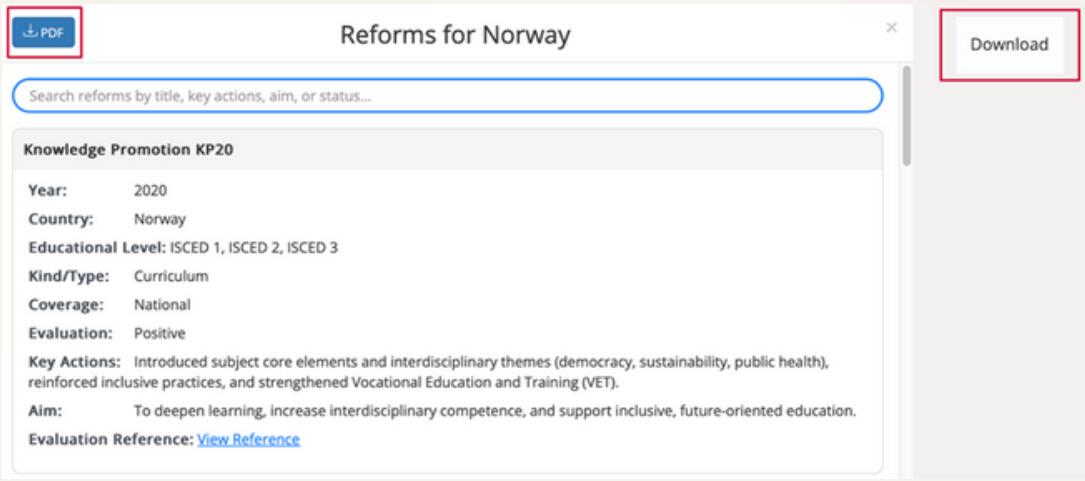


Figure 19. Example of PDF summary displaying reform information for Norway

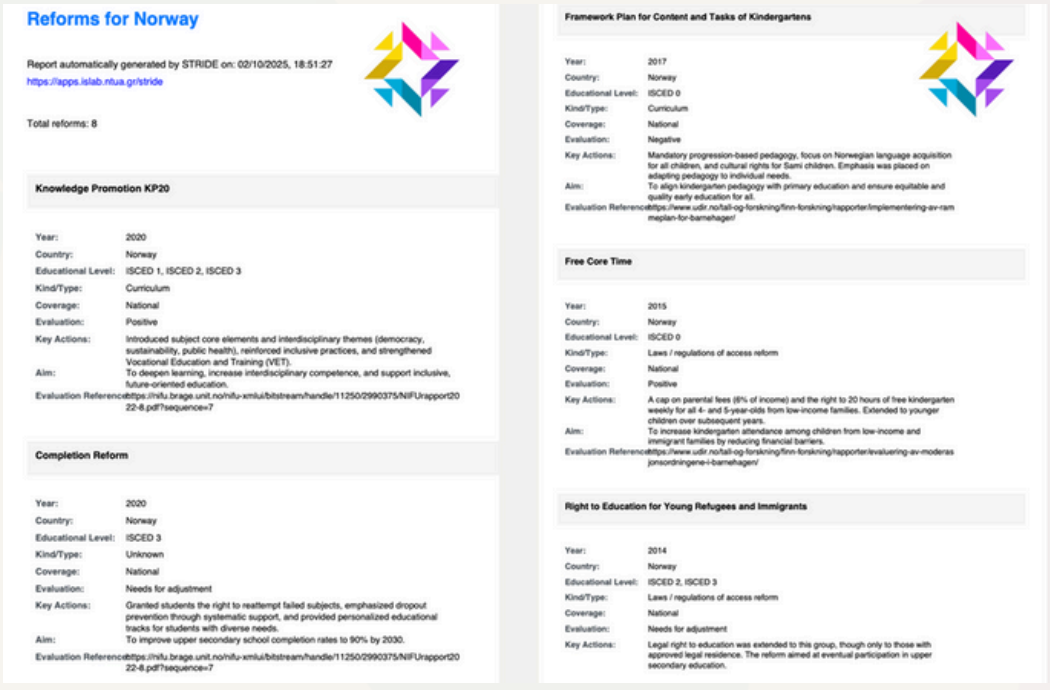
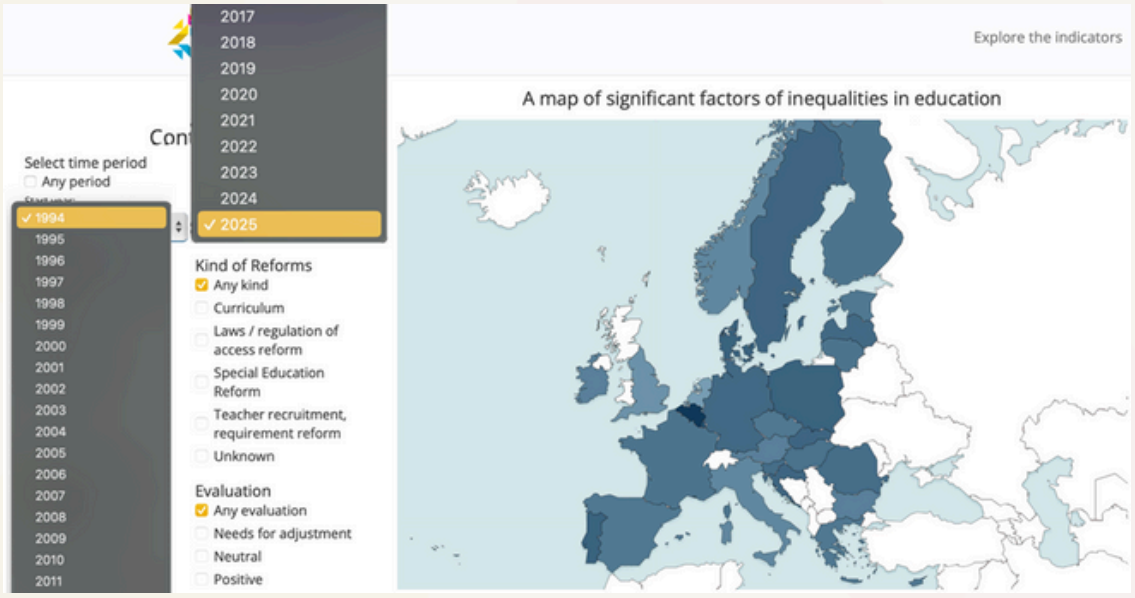
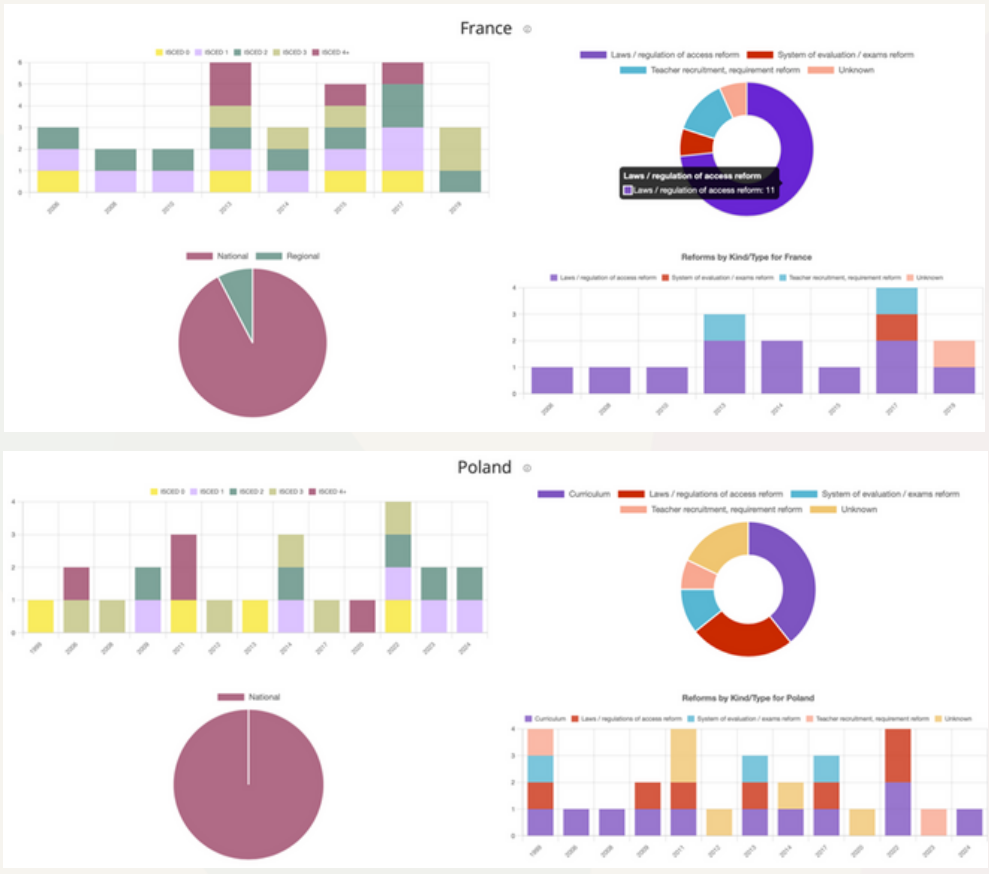


Figure 20. Start and end date selectors for filtering reforms by time period



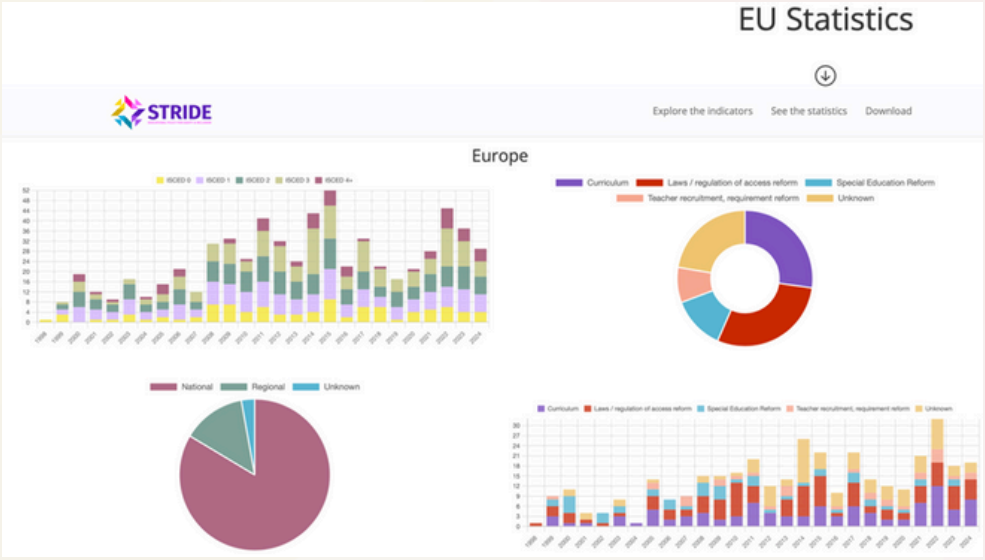
Below the map, country-level visualisations are presented, allowing users to explore summaries of reforms specific to each country. In addition, a European-level overview is provided, aggregating data across all countries. This enables users to identify cross-country trends and distributions, for instance, the total number of reforms implemented across Europe during a selected period or the frequency of specific reform types. As an example, Figure 21 illustrates the types of reforms undertaken in France and Poland.

Figure 21. Overview of reforms in France and Poland as shown in the country-level visualisation



At the EU level, the visualisation presents the number of reforms implemented by educational level and year, as well as by reform type and kind over time (Figure 22).

Figure 22. Overview of EU reforms



A summary of reforms across all EU countries is also provided (Figure 23). From this overview, it can be observed that, during the period under investigation, Belgium recorded the highest number of reforms, while the Netherlands had the fewest.

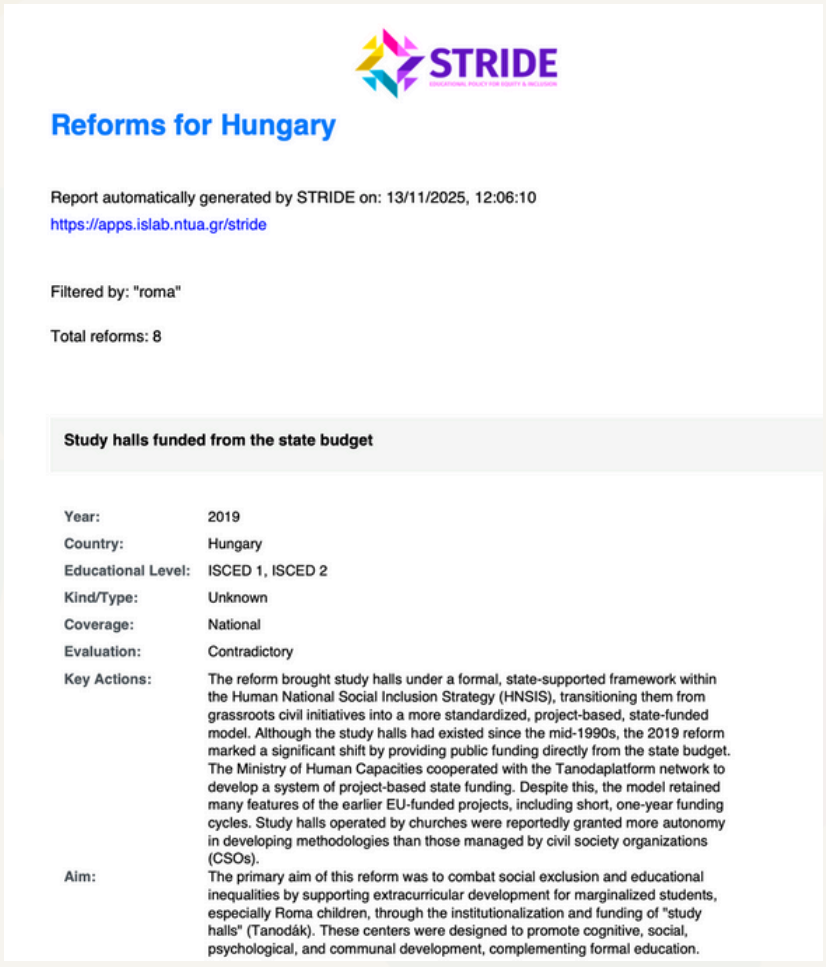
Figure 23. Summary of reforms across all EU countries

It is also important to note that the addition of a search function in the country-reports tool allows users to locate specific types of reforms. For example, if one wishes to identify reforms targeting Roma students in Hungary, the search feature enables the quick retrieval and examination of all reforms that specifically refer to Roma inclusion (Figure 24).

Figure 24. The use of the search functionality for isolating specific policy reforms, here targeting at Roma students in Hungary

Users may also download a summary of the eight policy reforms in Hungary identified through their search, i.e., those targeting Roma students (Figure 25).

Figure 25. Summary of policy reforms in Hungary specifically targeting Roma students (first page)



4. Linking the map to STRIDE's website

All available options for linking the interactive map to STRIDE's website have been reviewed and tested. One option involves hosting the map on the Artificial Intelligence Laboratory of the National and Technical University of Athens (NTUA), following the approach successfully applied for DGmap. In this case, users accessing the Interactive Map via https://stride-research.eu/interactive-map/ would be redirected to the external hosting environment.

Alternatively, the technical requirements for integrating the map directly within the STRIDE website (https://stride-research.eu) have also been examined. Several integration methods were evaluated, ranging from simple embedding solutions, such as Inline Frames (IFrames) and Object elements, to more advanced techniques. Both the IFrame and Object element approaches were implemented and tested with the map, and both functioned correctly. The use of IFrames, in particular, has already been proven effective through the integration of DGmap, as demonstrated on the DGmap Integration Example page.

Should more complex integration scenarios be required, additional techniques are available to ensure a robust and seamless embedding of the map within the STRIDE platform.

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List of acronyms and technical terms

EU	European Union
REA	Research Executive Agency
UKRI	UK Research and Innovation public body
IAG	International Advisory Group (also mentioned in the text as International Advisory Board - a group of external, independent experts in education and social policy). This board leverages international expertise to enhance the project's research quality, relevance, and impact.
NSG	National Stakeholder Groups - established in each Consortium Member's country, representing a diverse mix of stakeholders, including representatives from public bodies, civil society organisations, student organisations, alongside individual scientists, teachers, and educators.
WP	Work Package - A component of the project work breakdown. It represents a group of project activities targeting common specific objectives.
D	Deliverable - a tangible output such as a report, prototype, working paper, or dataset that demonstrates the completion of a specific task or milestone set out in the project

List of STRIDE Work Packages

WP 1	Project management and research governance
WP 2	Policy analysis and meta-analysis in Europe
WP 3	The trends of inequalities in education achievement
WP 4	A map of significant factors of inequalities in education
WP 5	Identify effective policy initiatives and interventions
WP 6	A toolbox for effective policymaking and assessment of inequalities in education
WP 7	Impact pathways, public engagement & synergy building

Project Name: Strategies for Achieving Equity and Inclusion in Education, Training and Learning in Democratic Europe (STRIDE)

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Consortium:

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- Jagiellonian University (JU), Poland
- National and Kapodistrian University of Athens (NKUA), Greece
- VIA University College, Denmark
- TÁRKI Social Research Institute (TÁRKI), Hungary
- Roehampton University (RU), United Kingdom
- Lifelong Learning Platform (LLLP), Belgium

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Duration: 1 February 2024 - 31 January 2027 (36 months)
EU contribution: 2 637 503.00 €
Website: https://stride-research.eu/

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EDUCATIONAL POLICY FOR EQUITY & INCLUSION

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