ICSE Academy

Cluster 2
Diversity and inclusion in STEM education
Session 1
Introduction to Diversity and Inclusion in STEM Education

WELCOME TO THE CLUSTER: DIVERSITY AND INCLUSION IN STEM EDUCATION

- Session 1
  - Introduction to Diversity and Inclusion in STEM Education
- Session 2
  - Analysing Tasks
- Session 3
  - Analysing Inclusive Classroom Practices

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SESSION 1: Introduction to Diversity and Inclusion in STEM Education

- Aims:

  ✓ Raising awareness about diversity and inclusion in STEM education

  ✓ Exploring the potential role of STEM education in teaching about diversity.

  ✓ Discussing about

    o the underrepresentation of students with disabilities in STEM education

    o the continued underrepresentation of racial and ethnic minority students in STEM education.

    o the gender gap in STEM education.

    o the underrepresentation of students with low Socio-economic status

  ✓ Introducing how critical postmodern science pedagogy (CPSP) can be used effectively to raise awareness of diversity issues among students.

THE CASE OF CULTURAL DIVERSITY

What is your 'healthy lunch'?

- In mixed groups design a healthy, multicultural meal.

- Use a template of a plate where you can write down the ingredients of your healthy meal and use it as reference in your group discussions.

    - What are your criteria for a healthy, multicultural meal?

    - Which cultures are represented in your group?

    - What ingredients are included in your groups' meal?

    - Are your group's meal different from other groups' meals? What may be the cause for differences?

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INCLUSION – EXCLUSION IN STEM

Recalling experiences of exclusion and inclusion

- How it feels to exclude others as well as the experience of being excluded by others in STEM education?

- Breakout rooms – Groups of 5-6 members

- To complete this activity, fold your paper in half. Label the left column "Inclusion" and the right column "Exclusion".

INCLUSION – EXCLUSION IN STEM

- Inclusion. What does the word mean? Take a moment to think about an event during your childhood or teenage years when you belonged to a group and felt part of the community.

- Now think about exclusion. Take a moment to recall a childhood event from which you were excluded. In case you can't recall a personal memory, try to recall an event when someone else was excluded from a group activity.

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REFLECTIONS

- Now in your groups compare your two-word lists. Are there similarities and differences? Which list is longer (inclusion/exclusion)?

- Questions for reflections in groups:

1. How did you feel about being excluded?

2. How hard did you try to become part of a group?

3. What techniques did you use to try to get in?

Underrepresented groups in STEM Education

- What are the most underrepresented minorities in STEM industry? (in one word).

- What minorities in your class are less likely to succeed in STEM education?

➢ Use your devices to add words on the wordcloud.

Poll: https://www.menti.com/alpqmtmi8b1v

Results: https://www.mentimeter.com/app/presentation/alc4sy9gio5qemaxc9ttyssqw8b8kh8v

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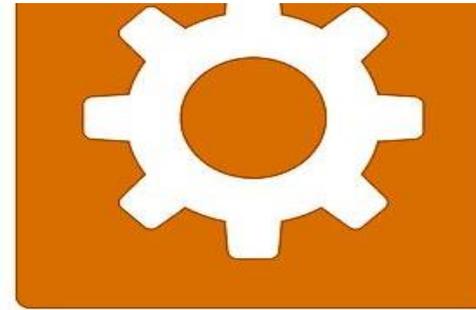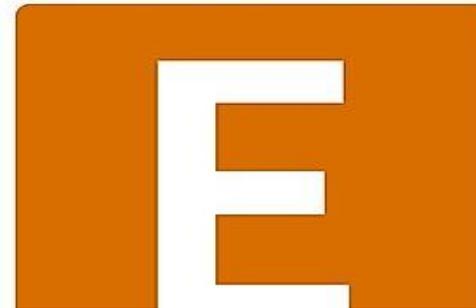
- Underrepresentation in STEM Education
    - students with disabilities in STEM education
    - racial and ethnic minority students in STEM education
    - Gender gap in STEM education.
    - Low socioeconomic status
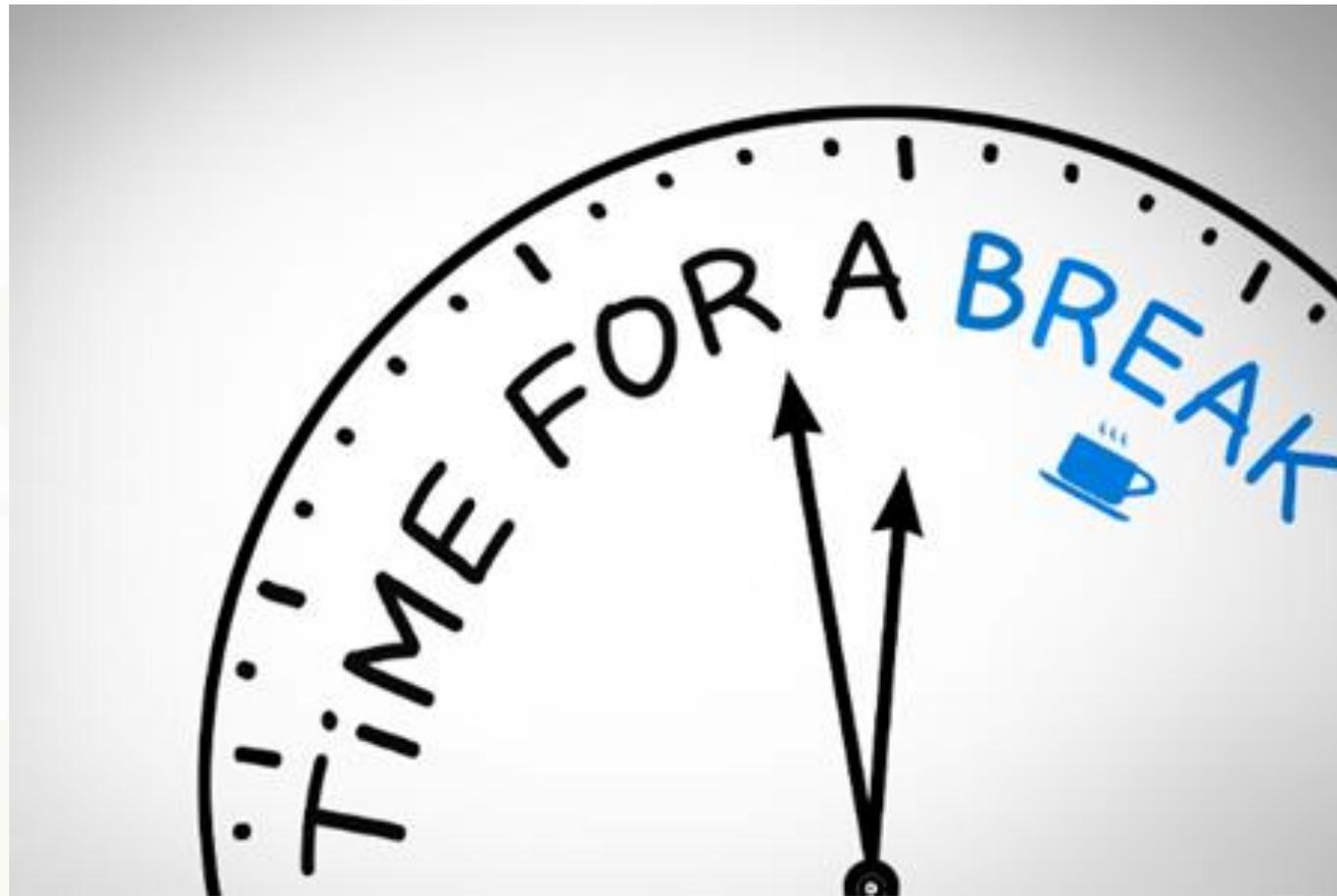
10 mins

Exploring Diversity and Inclusion in STEM Education

Group activity

- Each group focuses on different minority that is underrepresented in STEM education.

- Employ your personal experiences

- Use your devices to access some information on the internet

  - i.e. statistics that represent demographics of the STEM workforce in the EU or relevant articles and other publications.

- Post a few points under the corresponding column on Padlet

  - https://padlet.com/kdemetriou/underrepresented-minorities-in-stem-education-7nnifrr4b987otjn

- What are the barriers to diversity and inclusion in STEM education?
- Any ideas how these barriers can be tackled?

Diversity and Inclusion in STEM Education

- Definition of Human Diversity
  1. Human Diversity encompasses various dimensions that distinguish groups and individuals from one another.
  2. It involves respecting and valuing people for their differences, which can include age, gender, ethnicity, religion, disability, sexual orientation, education, and national origin (Felder, 2019).

- The Significance of Celebrating Diversity
  1. According to Felder (2019), "celebrating diversity" goes beyond mere acknowledgment; it is a commitment to preventing discrimination.
  2. This celebration aims to address historical and contemporary discrimination, particularly concerning disabled individuals.
  3. Its goal is to transform negative experiences into neutral or positive ones, thus placing disability on an equal footing with other facets of human diversity (Felder, 2019, p. 2).

- Embracing and Promoting Inclusivity
  1. Human diversity should be celebrated through inclusivity.
  2. Encourage an environment where differences are embraced, and everyone is treated with respect, regardless of their unique characteristics.
  3. Promote diversity and inclusion as essential values in both personal and professional spheres.

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Diversity and Inclusion in STEM Education

- Inclusion
  1. Inclusion is a globally recognized policy issue with far-reaching implications.
  2. It has gained prominence due to its potential to foster a more equitable and diverse society.

- Diverse Definitions of Inclusion
  1. Scholars have not reached a consensus on a singular definition of inclusion.
  2. The interpretation of inclusion varies across different contexts and perspectives.
  3. This diversity in definitions reflects the complex nature of the concept.

- Societal Obstacles to Inclusion
  1. Society can inadvertently create barriers that hinder the inclusion of individuals from various ethnic, racial, cultural, or linguistic backgrounds.
  2. A tendency to overlook individual differences can perpetuate these obstacles.
  3. Society often places the burden of adjustment on individuals rather than recognizing and accommodating their unique characteristics.

- Shifting the Focus to Societal Change
  1. Inclusion calls for a fundamental shift in societal norms and expectations.
  2. It is not solely about changing individuals but transforming the social structures and attitudes that perpetuate discrimination.
  3. Discriminatory social markers such as ableism, ageism, classism, heterosexism, racism, and sexism need to be addressed to achieve true inclusion (Cranmer, 2020).

Diversity and Inclusion in STEM Education

- Inclusion Beyond Society: Education Context
    1. Inclusion extends its significance to the realm of education, known as inclusive education.
    2. Inclusive education is now a part of policy documents in every country.
    3. It emphasizes the provision of equitable educational opportunities within mainstream schools, which are expected to accommodate all students, irrespective of their individual characteristics (Demetriou, 2022; Symeonidou, 2017).

- Expanding the Scope of Inclusive Education
    1. Inclusive education originally emerged as a response to the need for equal education opportunities for disabled children.
    2. However, its scope has broadened to include students from diverse ethnic, racial, cultural, or linguistic backgrounds (Forlin, 2010).

- Fostering Acceptance of Differences
    1. Inclusion in education is a powerful tool for promoting acceptance of diversity within educational settings.
    2. It provides a framework where all children, regardless of their abilities, gender, language, ethnicity, or cultural origin, are valued equally.
    3. Inclusive education ensures that students are treated with respect and offered equal opportunities within the school environment (Thomas, Walker, and Webb, 1998, p. 15).

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Diversity and Inclusion in STEM Education

- The case of dis/ability.
  - Underrepresentation of students with disabilities in STEM education

- The case of multiculturalism: ethnicity, race, religion and language
  - The continued underrepresentation of racial and ethnic minority students in STEM education

- The case of gender and sexual orientation
  - The gender gap in STEM education
  - European Parliament resolution of 10 June 2021 on promoting gender equality in science, technology, engineering and mathematics (STEM) education and careers.

- The case of economic status and social class

Disability and STEM education

- Representation of people with disabilities in STEM is an under-researched area (Schneiderwind & Johnson, 2020).

- Research on students with disabilities tends to group them as a whole rather than separating them into those with intellectual or learning disabilities and those with other disabilities
  - significant effects on the outcomes of research as it pertains to education.

- Moon et al. (2012)
  - "teachers, instructors, and professors are frequently unable, unprepared, or otherwise ill-equipped to recognize and address the needs of students with disabilities. As a result, course content may be inaccessible."
  - If students cannot access opportunities that feed into a STEM pipeline, they remain underrepresented in STEM fields.

Multiculturalism and STEM education (ethnicity, race, religion and language)

- Continued underrepresentation of racial and ethnic minority students in STEM education
- Academic mindset or the psychology and key beliefs of a student (Rattan, Savani, Chugh, & Dweck, 2015; Walton, 2014).
  - Sense of "belonging" or acceptance and fit in STEM (Ito & McPherson, 2018).
  - Impact on feelings of acceptance: uncertainty about whether they belong in their academic fields than students from well-represented demographic groups (Ito & McPherson, 2018; Walton & Cohen, 2007; Zaniewski & Reinholz, 2016).
  - Feelings of belonging and interest in STEM contribute to a student's STEM identity or the degree to which someone perceives STEM to be a key component of their sense of self (Kim & Sinatra, 2018; Robnett, Nelson, Zurbriggen, Crosby, & Chemers, 2018).
  - Viewing intelligence as fixed and something students cannot change (fixed mindset) or instead viewing it as something that can be developed over time with effort and dedication (a growth mindset).
- Feeling a greater sense of belonging in STEM can have a positive impact on academic achievement and retention in STEM, particularly for women and students of color (Rattan et al., 2015).
- STEM belonging in underrepresented students may be influenced by relationships with mentors (Robnett et al., 2018).

(Kricorian et al., 2020)

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Gender and STEM education

- Very low number of female students in STEM, in the US
  - Female high school students made up only 15% of engineering technologies concentrators, 8.5% of manufacturing, 14.5% in computer and information sciences, and 9.6% in construction and architecture (National center for education Statistics, 2005).
- Possible reasons
  - women in science are still paid less, promoted less, and win fewer grants (Nimmesgern, 2016)
  - large-scale Dutch study → the choice of science and maths subjects by girls is more influenced by their family background than the choice of boys (van Langen et al. 2006).
  - Girls' perceptions about their own competence in STEM subjects.
- Why is it important to have more women in STEM?
  - The absence of women from STEM education and careers affects more than the women; it is a missed opportunity for those fields (Milgram, 2011).
  - Women bring a different perspective that shapes and influences STEM disciplines (Milgram, 2011).
- The role of role models
  - Women and girls need to see female role models in the workplace that look like them (Milgram, 2011).

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Low Socio-economic status and STEM education

- The most commonly cited barrier to educational participation relevant to STEM is the relative cost of education (Gorard, & See, 2009).

- Many students continue with extended education in STEM because they report believing, they will gain in the long-term through enhanced earnings (Glover et al. 2002).

- Others leave for the same reason; they see education as a poor alternative to earning money in a job (Ulrich 2004).

- Impact of schooling
  - Initial schooling (i.e. school type, qualification level obtained, age of leaving) increases the accuracy of prediction to 90% (Gorard & Rees, 2002).
  - Possible explanation: family poverty, lack of role models, and a sense of 'not for us', poor experiences of initial schooling → create this kind of lifelong attitude to learning – a negative learner identity (Gorard, & See, 2009).

Diversity and Inclusion in STEM Education

- Diversity as resource

Paradigm shifts: from homogeneity to heterogeneity to diversity

Homogeneity
Learners grouped in one kind of educational institution are perceived to be similar and therefore get the same treatment.

Difference not acknowledged

Heterogeneity
Learners are perceived to be different. Adjustments are made to come to terms with their different needs.

Difference seen as a challenge to be dealt with.

Diversity
Learners are perceived to be different. Their difference serves as a resource for individual and mutual learning and development.

Difference seen as an asset and opportunity

What is the position of your school in this respect? (mark with an X)

Source: MaSDiV project

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Self-reflection tool

- **Preparatory task:** Self-Reflection tool developed by the American Psychological Association before they come to the session

- This tool helps teachers to make their classrooms and school environments more inclusive and diverse. It is a simple tool and a good self-reflective exercise for teachers.

https://forms.office.com/e/nPfaanKSAs

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CONSIDERING DIVERSITY

A SELF-REFLECTION TOOL FOR S T E M TEACHERS

ADAPTED FROM THE SELF-REFLECTION TOOL FOR PSYCHOLOGY TEACHERS DEVELOPED BY THE AMERICAN PSYCHOLOGICAL ASSOCIATION

Diversity and access are major topics of discussion in education. The discipline and society benefit when all students, regardless of race, ethnicity, gender, sexual orientation, disability, religion, socioeconomic status, national origin, age, language, and culture, are exposed to diverse perspectives on important issues confronting our society. Diversity education is not simply about infusing relevant topics across the curriculum but also requires teachers to examine themselves, their classrooms, and their school communities. STEM teachers are uniquely positioned to explore and engage in issues of diversity.

This tool helps teachers make their classrooms and school environments more inclusive and diverse. This questionnaire is simply a tool and not a test; it is a self-reflective exercise for STEM teachers.

Results from this instrument may be used for:

- Pre-planning for instruction or mid or end of year reflection
- Evidence of exemplary practice during administrator evaluations/observations

INSTRUCTIONS: USING THE SCALE BELOW, EVALUATE TO WHAT EXTENT THESE QUESTIONS ARE REFLECTIVE OF YOU IN THE LAST 6 MONTHS OF TEACHING

ABOUT ME

1. I am aware of the assumptions that I hold about people of cultures and groups different from my own.
   ☐ Strongly Disagree   ☐ Disagree   ☐ Neither Disagree Nor Agree   ☐ Agree   ☐ Strongly Agree

2. I am aware of how my identity and cultural perspective influence my judgment.
   ☐ Strongly Disagree   ☐ Disagree   ☐ Neither Disagree Nor Agree   ☐ Agree   ☐ Strongly Agree

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Forum: Self-reflections

- Use the results from the self-reflective exercise to reflect upon your current educational settings and teaching practices

  - How diverse do you consider your teaching settings?

  - How inclusive and diversity-friendly do you consider your approaches?

  - Is there a common ground in your country regarding the level of diversity and the current inclusive practices?

  - What about similarities and differences with colleagues from other countries?

The more **reflective** you are,

the more **effective** you are

https://docs.google.com/document/d/1thAAUKBs2XEXMnwQC7cejPboUk_fOXksMa6i3gjCEJg/edit?usp=sharing

← Fill in the table

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- Session 2
  - Analysing Tasks
- Session 3
  - Analysing Inclusive Classroom Practices

Upcoming Sessions

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