TOWARDS STEM CURRICULUM TRANSFORMATION IN AFRICAN UNIVERSITIES

Overtoun Jenda
Assistant Provost and Professor of Mathematics
1. Reasons for change
2. Challenges faced when transforming STEM curricula
3. Transforming the STEM curricula
4. Best Practices for Improving Quantity and Quality
5. Some thoughts – Africa specific
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7. Discussion
1. Responding to Political Pressure
   • e.g. change for specific courses
2. Responding to needs of industry
3. Responding to leadership
   • e.g. interdisciplinary or general curricula or common core
4. Accommodating underprepared or at-risk students
5. Faculty want to inject new knowledge or exciting topics in the curricula
CHALLENGES FACED WHEN TRANSFORMING STEM CURRICULA

1. Rigid Curricula – not much room for change in terms of both the number and content of courses
   • E.g. literature vs chemistry
2. Universality of subject matter – so can only make minor tweaks
3. STEM language – tons of definitions most in English in our case.
4. Major transformations are resource heavy
   • E.g. use of local languages in STEM courses
5. Lack of commitment from current faculty
6. Accreditation Boards for programs in engineering, chemistry, etc
TRANSFORMING THE STEM CURRICULA

1. Answer why first? And push back when necessary (e.g. minor in witchcraft, no) (minor in herbal medicine, yes).

2. Including African perspectives – add History of Math that has African contributions to Math or STEM Topics course that has African Inventors or Innovations.

3. Using local scenarios and examples in courses where appropriate.

4. Using gender neutral examples

5. Getting industry input
   - e.g. Introduction of finite math or specialized statistics courses at lower level

6. Ensuring that resources are available
   - E.g. faculty positions, materials, cost of developing new textbooks, etc
   - E.g. use of local languages in STEM courses could be costly with little benefits

7. Ensuring quality of the curriculum is not compromised
BEST PRACTICES FOR IMPROVING QUANTITY AND QUALITY

1. Less interference from outside if students get good grades and graduate.

2. Introduce remedial courses (adds one year to the curriculum)

3. Introduce academic year or summer undergraduate research experiences and internships and have undergraduate attend research conferences

4. Hands on projects in courses where applicable
   - E.g. Learn my making

5. Add computational methods sections in theoretical courses

6. Provide after hours free tutoring – mandatory at times – run by departments or Faculty.

7. Be deliberate in mentoring students, especially black students, female students, and persons with disabilities in STEM
SOME THOUGHTS – AFRICA SPECIFIC

1. Africa cannot afford to remain behind in STEM

2. Volume of STEM knowledge is growing exponentially. So focusing on cultural relevance or cultural identity in STEM while trying to play catch-up may be a misplaced priority.

3. If students fail it is not because the courses do not reflect African culture. If that was the case all history majors would be A students.

4. Okay to transform humanities but STEM primary focus should be better performance of students in current curricula.

5. May want to localize the problem
   - At tertiary level focus on courses and interventions in gatekeeping courses. E.g. courses may be replaced or reordered. May add orientation or medical ethics during 1st of year of BSc or have common core across institutions.
1. Continue to focus on rigor since students have to compete globally **BUT** let us help out those that need help (not survival of the fittest).

2. Every effort must be made so that underprepared and underrepresented groups are helped and welcomed, and participate in interventions through academic retention programs
   - E.g. science Drop-In Centers; Peer-mentoring programs

3. Academic retention programs must be run by STEM faculty. Here the NRF can play a role by providing funds for students and faculty’s release time

4. Curricula should be reviewed continuously without pressures from outside. But when that happens, then power for tweaking and transformation must remain with undergraduate committees. Need buy-in from faculty.
1. Tweak STEM course delivery so that they are engaging and interesting
   • Use local examples and improve quality of lecturers
   • Learn by making. Make equipment that could solve community problems through interdisciplinary teams.

2. Universities need to engage schools to strengthen school curriculum otherwise you will be asked to transform your curriculum eventually

3. Provide national and international research experiences for undergraduates
   • E.g. Research Experiences for Undergraduates (REU) programs and SAMSA Masamu program
REMARKS - GENERAL ADVICE

1. If it ain't broke, don't fix it
2. Volunteer to come up with solutions within the discipline – don’t lose the narrative
3. Continuously Engage Decision Makers
THANK YOU!!!!!

CONTACT INFO

Overtoun Jenda
Email: jendaov@auburn.edu
Web: https://cws.auburn.edu/apspi