# **Education Systems in the Age of Automation and Artificial Intelligence**

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## **Introduction**

The rise of artificial intelligence and automation technologies is creating significant changes in how we work and what skills are needed in the economy. Many jobs that people do today might be done by machines in the future, which means that education systems need to adapt to prepare students for this new reality. This essay will examine how education should change to help students succeed in a world where AI and automation are more common.

The main question is whether schools and universities should focus more on STEM subjects like computer science and engineering, or whether they should emphasize soft skills like communication and critical thinking. Both approaches have advantages and disadvantages, and the best solution probably involves some combination of both. I will look at the economic arguments for each approach and suggest some policies that could help create a workforce that can work well with new technologies.

## **How Automation Affects Jobs**

Automation has been changing the job market for many years, but the pace of change is getting faster. According to human capital theory, education is an investment that makes workers more productive and helps them earn higher wages (Becker, 1964). However, when machines can do jobs that humans used to do, this changes what skills are valuable in the labor market.

Research shows that automation particularly affects routine jobs - both manual jobs like manufacturing and cognitive jobs like data entry. Jobs that require creativity, social interaction, and complex problem-solving are less likely to be automated. This creates what economists call job polarization, where middle-skill jobs disappear while high-skill and low-skill jobs that require human contact remain.

Frey and Osborne (2017) estimated that 47% of US jobs are at high risk of automation in the next two decades. This includes jobs like bank tellers, retail salespeople, and even some professional jobs like paralegals and radiologists. However, jobs in education, healthcare, and creative industries are expected to grow because they require human skills that are difficult to automate.

In the UK, similar patterns are emerging. The ONS has found that routine manufacturing jobs have declined significantly since the 1980s due to automation and globalization. At the same time, jobs in professional services, healthcare, and education have grown. This suggests that workers need different skills now than they did in the past.

## **The Case for STEM Education**

There are strong economic arguments for increasing investment in STEM education. First, there is high demand for workers with technical skills. The government estimates that the UK faces a shortage of about 173,000 STEM workers each year, particularly in engineering and computer science. This skills shortage drives up wages for STEM graduates - they typically earn more than humanities graduates both initially and throughout their careers.

Second, STEM skills help workers understand and work with new technologies rather than being replaced by them. As AI becomes more common in workplaces, people need to understand how these systems work and how to use them effectively. Programming, data analysis, and technical problem-solving skills are becoming more valuable across many industries.

Countries that have invested heavily in STEM education have generally seen positive economic results. For example, South Korea's focus on technology education has helped it become a leader in electronics and telecommunications. Similarly, Germany's strong engineering education system supports its successful manufacturing sector.

However, focusing only on STEM subjects may not be the best approach. Technical skills can become obsolete quickly as technology changes, and many STEM graduates struggle to find jobs that match their qualifications. There is also a risk that overemphasizing technical subjects could neglect other important capabilities.

## **The Case for Soft Skills**

Soft skills like communication, teamwork, and critical thinking are becoming more important as automation takes over routine tasks. These skills are difficult for machines to replicate, which means humans will continue to have advantages in jobs that require them.

David Autor's research shows that jobs requiring social skills have grown faster than other occupations since 1980. This includes jobs like managers, teachers, healthcare workers, and sales professionals. These roles require emotional intelligence, persuasion, and the ability to work with other people - capabilities that remain uniquely human.

The World Economic Forum has identified creativity, critical thinking, and emotional intelligence as key skills for the future workforce. As machines handle routine information processing, humans become more valuable for their ability to generate new ideas, solve complex problems, and manage relationships with colleagues and customers.

Countries like Finland and Denmark that emphasize creativity and critical thinking in their education systems have maintained low unemployment rates despite high levels of automation. This suggests that soft skills can provide protection against technological unemployment.

However, developing soft skills is more difficile than teaching technical subjects because they are harder to measure and evaluate. Its not easy to test creativity or teamwork in the same way you can test mathematical knowledge.

## **Economic Analysis of Different Approaches**

From an economic perspective, both STEM and soft skills contribute to productivity and wages, but in different ways. STEM skills tend to have immediate, measurable effects on productivity, especially in technology-intensive industries. Workers with programming or engineering skills can directly contribute to developing and implementing new technologies.

Soft skills have more indirect but potentially longer-lasting effects. They help workers adapt to changing circumstances, work effectively in teams, and take on leadership roles. Research suggest that workers who combine technical knowledge with strong communication and management skills earn the highest wages over there careers.

The complementarity between different types of skills is very importante. Workers who have both technical competence and soft skills are often more valuable than those who specialize in only one area. This suggests that education policy should not force a choice between STEM and liberal arts but should find ways to develop both.

Labor economics theory supports this integrated approche. The concept of skill-biased technological change suggests that technology increases demand for workers who can complement new systems rather than compete with them. This means education should focus on developing capabilities that work well with AI and automation rather than trying to replace them.

## **International Examples**

Several countries provide examples of successful educational adaptation:

Germany's dual education system combines classroom learning with workplace experience, helping students develop both technical skills and practical problem-solving abilities. This has contributed to low youth unemployment and strong economic performance in manufacturing.

Singapore has made substantial investments in both STEM education and lifelong learning. Its SkillsFuture program provides funding for adult education while schools emphasize both academic achievement and creativity.

Finland's education system is known for balancing academic rigor with creativity and collaboration. Finnish students perform well on international tests while also developing strong critical thinking and social skills.

## **Challenges and Limitations**

There are several obstacles to implementing these changes. First, educational reform is expensive and requires sustained political commitment. Upgrading technology infrastructure, training teachers, and developing new curricula all require significant investissement.

Second, there may be resistance from educators and employers who are comfortable with current approaches. Change is always difficult, and stakeholders may be sceptique about new methods.

Third, it is difficult to predict exactly what skills will be most valuable in the future. Technology evolves rapidly, and today's cutting-edge skills may become obsolete within a few years. This makes it hard for schools to know what to focus on.

Finally, there are equity concerns. Students from disadvantaged backgrounds may have less access to technology and high-quality education, which could increase inequality if reforms are not carefully designed. This is a serieux problem that needs attention.

## **Conclusion**

Education systems need to adapt to prepare students for an economy increasingly shaped by AI and automation. The evidence suggests that the most effective approach combines technical literacy with soft skills rather than focusing exclusively on either STEM or humanities education. This requires significant reforms to curricula, teaching methods, and assessment approaches, supported by increased investment in lifelong learning opportunities.

While there are challenges to implementing these changes, the economic benefits of a workforce that can effectively collaborate with AI and automation systems are substantial. Countries that successfully reform their education systems are likely to achieve higher productivity growth and better employment outcomes for their citizens.

The key is to recognize that humans and machines have different comparative advantages and to design education systems that maximize human potential in areas where we continue to excel: creativity, social interaction, ethical reasoning, and adaptive problem-solving.

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