Citation: Arkoh BP, Marful AB (2023) Strategies for Introducing Robotics and Automation in Architectural Pedagogy in Ghana. The Case of KNUST. J Archit Eng Tech 12:353.

Ancient Africa: Egyptian lore states that in the new kingdom of Egypt, religious statues made from stone, metal or wood responded to consultations of worshippers with movement of the head.

European Christian legend:

have handled domestic tasks was destroyed by his student Thomas Aquinas for interrupting his meditations.

Ancient India: Lokapannatti, a set of Indian cycles and lore produced in the 11th or 12th centuries AD, describes stories of automated soldiers called

safeguard the relics of Buddha in a hidden stupa. It is believed that the Indians stole the plans for developing these humanoids from the kingdom of Rome.

Ancient China: In chapter 5 of the Daoist text, King Mu of Zhou on his Western tour had the craftsman master Yan performs for him. Master Yan presented the court with automated human forms that performed diverse stunts for the king and his subjects.

Ancient Greece: The legend Cadmus sewed dragon teeth which transformed into soldiers, also Hephaestus also created self-controlled three legged tables and a man made of bronze called Talos, the defender of Crete.

Scientific developments of robotics

Through the centuries, robotics has seen numerous scientific developmental phases (Figures 1 and 2). Predominant of these are:

Nineteenth century: Nikola Teslaôs electrical boat invention which had the radio remote control feature was used in World War. Teslaôs invention was first unveiled with his submersible boat model at the Madison Square Garden in the year 1898.

Twentieth century: The word ñrobotò was first used in 1921 in a drama published by the Czech Karel Capek. The satire, Rossumôs universal robot, in which robots were described as biological beings responsible for manual work. Simons makes us understand that the word robot comes from the Czech ñforced laborò.

In 1942 the word ñroboticsò was formed. Isaac Asimov, the Russian-born American science-fiction writer, initially used the term in his literary piece called ñRunaboutò. Asimov held a contrary view to that of Capek by depicting robots as a better, neater race that are helpful to humans. Asimov suggested three laws of robotics that his robots followed:

First law: A robot may not injure a human being or through inaction, allow a human being to come to harm.

Second law: A robot must obey the orders given it by human beings except where such orders would conflict with the first law.

Third law: A robot must protect its

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Branches of robotics and automation

Robotics: Robotics comprises numerous branches, most relevant to architecture pedagogy and practice these are:

5RERWLF PDSSLQJ The branch of robotics that deals with autonomous robots constructing and localizing maps and/or floor plans.

5DSLG SURWRW\SLQJ Automated construction of tactile objects by additive manufacturing from virtual models CAD software, creating them into thin horizontal sections and printing successive layers until the model is complete.

6LPXOWDQHRXV /RFDOL]DWLRQ DQG 0DSSLQJ 6/$0 The science of using autonomous robotic vehicles to create maps within unknown surroundings or to update a map within a known environment simultaneously keeping track of their current location.

Artificial intelligence: The science that studies the simulation of human intelligence making computer systems act with human cognition.

Automation: Generally, there are two main branches of automation; industrial automation and software automation.

Industrial automation: Industrial automation employs control devices thus eliminating human labor to manage industrial processes and machinery. Advances in technology have resulted in a gradual transition from mechanization which required human interventions to industrial automation which utilizes physical machines and control systems to automate tasks. There are two types of Industrial automation; process plant automation and manufacturing automation system (Figure 9).

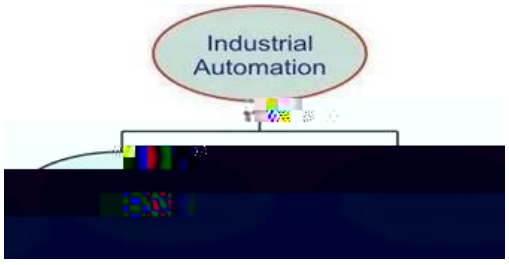

Figure 9: What is industrial automation.

Software automation: Software automation refers to computer based tools designed to undertake repetitive tasks which comply with a particular logic. There are three sub-categories of software automation: Business Process Automation (BPA), Robotic Process Automation (RPA), and Intelligent Process Automation (IPA).

Merits of robotics and automation in architecture

Promoting sustainability: Automated devices help ensure energy efficiency. The use of ñedge monkeysò regulates energy use by signaling internal occupants upon detection of energy wastage, regulating facade treatments to allow daylight into internal spaces.

Safer work environments: Robotics and automation technologies are utilized in dangerous site work such as demolishing process, building stages at high heights, drilling and below grade activities; drones, for example are capable of fire safety inspection, tracking work progress and alarming potential dangers at initial stages.

Curbs skilled labor shortage: Effective in precision while simultaneously reducing labor cost and improving overall work productivity and quality.

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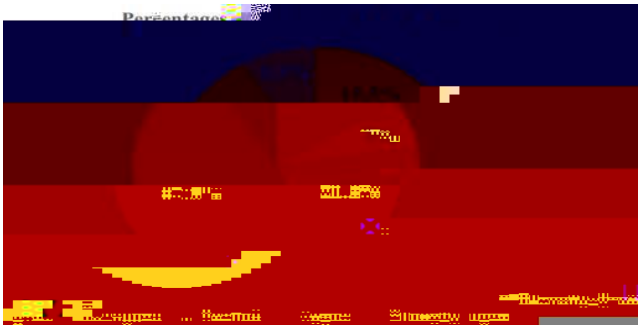

Figure 12: Percentages of respondents that have

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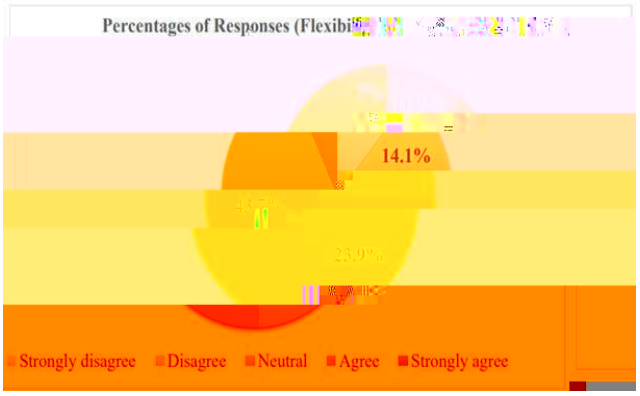

Figure 16: Perspective of respondents on studio structure.

The results indicate 43.7% of respondents agreed that their current studio set-up allows for the use of robotics and automation technologies in studio assignments. With 23.9% of the respondents holding a neutral stance, a sum of 25.4%, however, disagreed that studio structures permit the use of robotics and automation technologies in studio sessions.

The survey enquired views of respondents in relation to whether studio staff encourages students to use robotics and automation technologies (Figure 17).

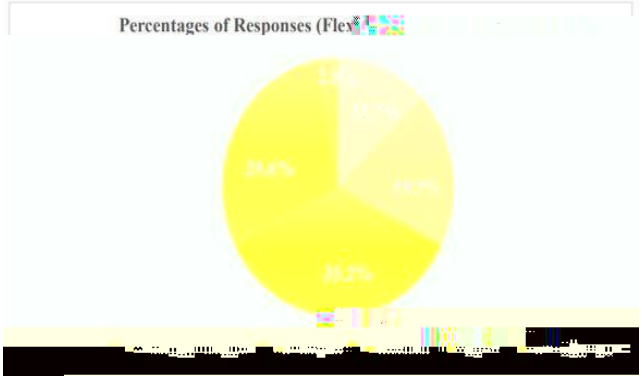

Figure 17:

The responses reflect a largely neutral stance with 35.2% of respondents hoarding an unobjectionable view. Results also showed equally split views with a sum of 32.4% of the respondents agreeing and disagreeing with the question.

The questionnaire survey compared the prior methods applied before the introduction of robotics and automation (Figure 18).

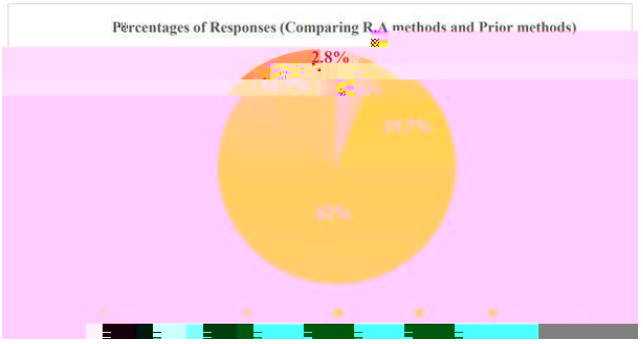

Figure 18: Percentages of responses; comparing robotics and automation methods and prior methods.

A convincing sum of 74.7% agreed that existent robotics and automation technologies introduced are better than prior conventional methods used in teaching and learning of architectural education. A sum of 5.6% of the respondents held a contrary view siding with prior methods being better than that of robotics and automation technologies (Figure 19).

Data collected shows an enthusiastic drive to welcome robotics and automation into architecture education as 38% agreed and 43.7% strongly agreed to readily partake in architecture inclined robotics and automation courses. Notable is the 1.2% and 2.8% of respondents that expressed reluctance in taking up courses in robotics and automation (Figure 20).