Smart AI Environment to Increase Student Engagement and Innovation Skills in HyFlex Learning Model

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Abstract

Smart classrooms, flipped classrooms, blended learning, adaptive learning, and e-learning are few of the major types of learning fashions that are being followed by educational sectors in Oman. "Vision 2040" focuses to sharpen the skills of the young students. Student learning approach and efficacy should not be decreased due to pandemic restrictions and limitations. The exiting methodologies would not be sufficient to fulfil the national objectives. Henceforth, we propose a novel smart environment for the HyFlex classrooms. HyFlex (Hybrid-Flexible) is a very modern model of class delivery that combines in-campus and remote learners simultaneously. Development of AI (Artificial Intelligence) based tool detects participants emotion using facial expressions and student attention using a smart e-learning setup. The AI notifications triggers up the teacher's presentation style and students learning approach that empower the youth knowledge. The implementation of 3D printers in HyFlex model boosts the creative skills through modelling, prototyping and product creations. This model is expected to create high impact among education sectors in Oman. The advanced setup overcomes the challenges faced by educational management and predicted to create a great impact in learning STEAM (Science, Technology, Engineering, Arts, and Mathematics).

Keywords: HyFlex Learning, Artificial Intelligence, Emotional Recognition, Educational Computing, Artificial Intelligence in Education

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Learning Model

The rapid innovations in Artificial Intelligence (AI) helps educational sector for

simulating human behaviors, and analysis for making decisions (Hwang, 2020). HyFlex or

Hybrid Flexible blends face to face learning and remote learning. Each action in this

environment is synchronic and asynchrony in online. The student can select the mode of

participation. The main motivation of this research raised based on "Oman Vision 2040" and the

directives to implement "Hybrid Learning" in schools by Government entities in Oman. The

mission is to propose a new platform to monitor the students for upskilling & reskilling the

young students using advanced technologies.

Literature Studies

They hybrid flexible subjects are intended to meet all students who are connected online

and offline by constructing "Instructional shape, content, and activities" in one group. There are

specific standards ought to be followed to design a HyFlex subject or course including presenting

the course content effectually, involving students in both modes by utilizing class tasks, applying

sufficient assessments that are acceptable for category of students (Beatty, 2014). With the

increase of smart phone usages, learning fashion is emerged with the smartphone technology in

e-Learning specifically accessing resources online through cloud based-repertory. The

drawbacks of using OER (Online E-learning Recourses) are considered as Responsive web

design (RWD) where accessing the online resources through smartphone is not friendly to the

reader which does not support the smartphone GUI for example, the text too small so they have

to zoom in and zoom out continuously to follow up reading documents. So, the smart devices

should have RWD that is less complicated and more convenient to the user. Another pitfall is

Internet connectivity. Accessing OER depends on having good Broadband Internet Services. If the resources are internet-based or cloud-based access it would be difficult to access them for those who have low internet connection or even lack of internet service, like remote rural areas residents. As result, this influenced the difference in the learning processes between the students who have good internet connectivity and students without the internet service (Reinald, 2016). Sirisakpanich 2022, discussed the perceptions of the teachers and the student regarding the blended classroom and determining what are the strengthen and weakness points. It is also discussed the impacts of the blended learning. Teachers' challenges are in delivering the educational outcomes for blended learning classes. For getting an affective blended learning they must have a machine to support the interaction between teachers and students and keep them motivated. Wannapiroon 2022, explored about why STEAM education is crucial. STEAM education helps the students to solve real life problems, and how STEAM important for creative thinking, innovation and that are applied digitally. The Virtual Classroom Learning Environment (VCLE) is a mixture of virtual classes and digital learning fashion. Five steps are used in STEAM education via VCLE and they are: investigate, discover, connect, create, and reflect. They determined that the STEAM education approach is a powerful educational technique to develop blended/flipped learning. The students who studied using VCLE-STEAM methods they are more creative and innovative than the students who studied according to normal techniques.

Reasons for Using HyFlex

To serve the distance learners who they must travel several miles to and from the campus daily. And also, to save the time and cost spent by students to attend the classes in person (Beatty, 2014). Another reason is because of the increase of the student's population and the shortage in the number of teachers. HyFlex option is a feasible alternative to access courses to

get more credits from missed or failed courses. The schools which started running virtual classes have received less school funding than the previous years (Kumi-Yeboah, 2014). The students who have poor internet connectivity they can get the updated resources by synchronizing them whenever they got the connection (Reinald, 2016).

Review on Methodologies

It is believed that the use of Online E-learning Resources (OER) for faster access and reach more cost-effective rate (Kumi-Yeboah, 2014). Reinald 2016, used a model that converts the WordPress site into Android App. This native application integrates the primary elements, that supports to view the resources as web application and able to perform synchronization. BLAP/HTTrack approach is also used to display the resources from warehouse by performing like a web-browser. HTTrack is used for synchronizing the resources, that permits downloading the resources locally on the mobilephone. HyFlex model is implemented in reputed universities in UK, USA however, AI based facility is not integrated to monitor the online learning students' attentions, emotions, and performance during their classes.

Proposed Model

It is learnt that situations like pandemic put some students to attend classes online. However, few others wanted to attend classes in direct from their classroom (face-to-face). It is challenging to handle two different categories of students in a same timeslot and class hour. To overcome the challenges, we propose HyFlex learning model with AI based add on features. The unique model would support the teachers to handle the students efficiently who have joined from remote and for those who are attending classes on-campus that enhances the students' skills. This project has two core modules. The first one is setting up the HyFlex model infrastructure and the second one is building the AI based python tool for emotional detection of students.

HyFlex Learning Model Setup

The hardware resources are primary for deploying HyFlex environment. Mainly the centralized hub, synchronous web conference model, video platform, cameras, microphones, speaker, display for teacher to view the students attending online, display for students to view the co-friends attending online, computer for teacher, tablets for students, integrated ecosystem support, on-demand service and accessibility and control to teacher in the class.

Emotional Recognition

The students who attend the classes from their classrooms are monitored by the teacher/instructor by face-to-face. However, it is also important to observe the online attendees equal to the offline attendees. It is very difficult to predict remote students' expressions from a poor camera video resolution, low lighting, and so forth. Therefore, an AI based smart application in required to monitor the online students. So that the system would provide live notifications to the teacher for further decisions. The most suitable model for implementing the emotional recognition would be a cognitive emotion detection algorithm and face emotion recognition algorithm. Python will be used to implement the same. The notion is to imitate the students thought process using training data. To compute the analysis the pre-recorded inputs shall be used, or a live stream video can be used for real time analysis. The inputs are either images or videos. Visual data are handled by the computer vision which is considered as a core feature of AI. Prediction of emotional features (intelligence and behavior) in video content is the ultimate task.

Input: Data	Isolation of Key Aspects	Comparison with Psychological Research	Output: Emotion

Figure 1. Programmatic Analysis of Sentiments

Cognitive science is used to study the student's brain and to realize the standard of intelligence. This operates in three modules of analysis including computational task, representation of algorithm and the hardware.

Implementation Plan

Sentiment analytics will be done with the use of FER (Face Emotional Recognizer). FER is a free open-source library in python. Set the MTCNN (multi-cascade convolutional network) model as "True" to activate to detect facial expressions, and detect_emotions() function helps us to evaluate results including fear, happy, depressing, neutral, anger, hatred in the scale between zero to one. FER () constructor would be called to identify the emotions. The python code takes the input images based on the intensity types in the output and the function top_emotion() is used to obtain the very prevalent emotion of the input image. Similarly, prediction of facial emotions from live videos would be detected using the image frames. Video_analyze() function will be used for extraction of frames to analyze individually. Creation of Pandas DataFrame using matplotlib will help to predict the sentiments present in the input video (Singh, 2021). Hence, the facial expression detection of a student would be successfully achieved. The notification setup would also be implemented to alert the teacher in the classroom.

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Conclusion

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The advancement and innovations in Artificial Intelligence has brought remote teaching and learning made easy. Implementing 3D printers in classrooms would create innovative atmosphere in educational system. Managing online class students and offline class students simultaneously would create a great impact in HyFlex learning environment. This could enhance the students progress and innovation skills. Due to certain constraints including the budget for HyFlex hardware infrastructure, the proposed model is planned to be implemented in near future.

References

Hwang, G., Xie, H., Wash, B.W., Dragan, G. (2020). Vision, Challenges, roles and research

    issues of Artificial Intelligence in Education. *Computers and Education: Artificial

    Intelligence 1*, Pages 25.

Beatty, B. (2014). Hybrid Courses with Flexible Participation: The HyFlex Course Design.

    Practical Applications and Experiences in K-20 Blended Learning Environments, Pages

    25.

Kumi-Yeboah, A. (2014). Trends of Blended Learning in K-12 Schools: Challenges and

    Possibilities. *Practical Applications and Experiences in K-20 Blended Learning

    Environments*, Pages 17.

Reinald A.D.L.P, Consuelo D.L.H, Roberto B.F. (2016). Hybrid online/offline mobile solutions

    for accessing open educational resources in areas with poor internet connectivity. *Asian

    Association of Open Universities Journal*.

Sirisakpanich, D. (2022). The Study of Challenges and Issues of Blended Learning in High

    School Education duringthe Covid 19 Period: A Focus Group Discussion. *Turkish

    Journal of Computer and Mathematics Education*, Pages 296-307.

Wannapiroon N, Pimdee P. (2022). Thai undergraduate science, technology, engineering, arts,

    and math (STEAM) creative thinking and innovation skill development: a conceptual

    model using a digital virtual classroom learning environment. *Education and Information

    Technologies*, Pages 25.

Singh, R. (2021). *The Ultimate guide to emotion recognition.* www.towardsdatascience.com

    (accessed on March 29, 2022)

HeFlex Learning Model Hardware. www.collegiseducation.com (accessed on March 28, 2022)