

The Impact of ICT Tools on Students' Perceptions and Achievement in a Sustainable Higher Education Environment

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Abstract :

The Covid-19 pandemic has changed the Higher Education system in that online and blended learning has become a fundamental demand of the whole world. Accordingly, education has a primary mission in Higher Education, which is increasingly depending on information technology leading to its continuous proliferation and development. The present study not only aims to investigate learners' perceptions of the use and benefits of the Information and Communication Technology (ICT) tools in blended courses as well as their relationships with learners' academic success and achievement, but also to identify the factors for the effective and efficient use of electronic resources in classes. It also aims to compare the impact of ICT- based and conventional methods of instruction on undergraduate learners' perceptions and academic achievement. The Constructivism

theory as well as the Uses and Gratification theory enabled the researcher to examine the way how learners feel satisfied with and motivated by the use of different types of media in a sustainable learning environment. A survey as well as interviews were administered in order to evaluate the acceptance and use of various ICT tools in a blended course. Not only have the data been analyzed using standard statistical techniques, but also a correlation analysis was implemented in order to examine the degree of association between the use of ICT tools and students' academic achievement. Results have shown a positive correlation between the integration of ICT tools in the blended course and learners' academic achievement.

Keywords. Blended Learning, Constructivism, Digital Learning, ICT Tools, Sustainable Development

Introduction

The World Health Organization (WHO) had declared Covid-19 as a global pandemic in mid March 2020, during which the Higher Education system moved from face-to-face to distance learning (Hell et al., 2021, p.31). Despite the pandemic difficulties, many educational institutions have taken remarkable measures which principally aim at ensuring academic progress (Toquero, 2020, p.2). In a technology-oriented environment, they have provided new learning opportunities in order to boost the quality of their services (Aithal, 2019, p.36).

According to UNESCO (2004, p. 10), literacy is no longer considered a self-contained skill; rather, it is a social practice impacting learners' lifelong learning. Accordingly, enhancing literacy has been a fundamental issue of enabling learners not only to read and write, but also to acquire Information and Communication Technology (ICT) skills as an integral part in the learning process.

Glasby (2015) defines online learning as “distance education delivered through technological solutions that do not require instructors and learners to be available simultaneously” (p.3). Fikou et al. (2022) argue that such new digital trends and technologies “are reshaping the way people work, communicate and learn” (p.19). They state that digital competence is beneficial in that “it reflects a person’s ability to use digital technologies in a critical, collaborative, and creative way” (p.19).

Lezer et al. (2020) argue that as technology changes constantly, modern universities are supposed to increase their responsiveness to such external changes depending on their flexibility and adaptability. They state that it is crucial to “ensure the safe and mutually beneficial access to all university resources using digital technology” (p.387). They

also claim that the infrastructure of a modern university is “not only premises, equipment, information services, teachers, and researchers, but also cultural values, investments, and access to the benefits of life quality” (p.388). They agree with Salisbury et al. (2019) that a significant factor for learners to meet the requirements of the digital learning environment is to boost the digital literacy of learners (p.388). Meng et al. (2019) agree that a student’s digital competence “reflects his/her information and communication technologies (ICT)-based knowledge and skills that can be used to perform ICT-related tasks” (p.3233).

In UNESCO’s (2018) framework for action, it has been stated that

By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through Education for Sustainable Development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and nonviolence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development (UNESCO, 2018, p.24)

This framework of Education in Sustainable Development provides “an integral element of the SDG on quality education and a key enabler of all other sustainable development goals” (p.25).

Gafurov et al. (2020) claim that digitalization “and transition to a new technological structure bring humanity to another level of development”. They also agree with Makori and Mauti (2016) about the digital revolution which “is powering and creating a wide array of information and knowledge products and services in organizations depending on their information and communication technology

systems”. Moreover, based on the Sustainable Development Goals of the United Nations Organization for Education, Science, and Culture (UNESCO), the use of ICT tools, i.e. digital tools, in the classroom fundamentally contribute to the guarantee of providing learners with inclusive and equitable education and developing their learning opportunities. It also contributes to the well-being and welfare of all individuals by means of the reduction of social and economic inequalities. In other words, ICT tools or digital tools are an invaluable aspect in a sustainable learning environment in which the learners’ needs are to be responded.

Literature Review

It is too difficult to define Information and Communication Technology (ICT) due to the constant changing nature of technology. Hismanoglu (2012) claims that ICT is considered “a platform for providing learners with opportunities in any field which is integrated into the classroom to complement and modify the pedagogical practice” (p.185). Makori and Mauti (2016) state that one of the advantages of Information and Communication Technology (ICT) is as quoted below

ICT has facilitated institutions of higher learning to be custodians of intellectual and capital knowledge assets. In universities, integration of ICT in learning helps to strengthen the importance of education to the increased networked society and enhances its quality by creating an active process of learning, increasing students’ motivation, providing a better access to information, and sharing of resources, thinking and communicating creatively” (Makori & Mauti, 2016, p.173).

In the past decades, communities have been increasingly dependent on technology in all aspects of life and education is no exception. Orús et al. (2020) claim that technology has

been presenting “enormous opportunities and challenges to educators” (p.5339). They cite what Willingham (2010) states about many new and innovative technology tools which “such as interactive whiteboards, computer-based presentation software, learning management systems, online tools, and wireless technologies, have been introduced to education during the past two decades” (p.23).

Orús et al. (2020) also emphasize that software developers such as Moodle and Blackboard “have been working with educators to expand the capabilities of course management systems to address the changing needs of student bodies” (p.5339). These learning management systems contribute in the connection of the students to all educational materials by means of the Internet. As a result, ICT tools are regarded as an integral part of the educational environment in which lessons, content, and ideas are presented dynamically and interactively. Moreover, Salisbury et al (2019) agree with Safiullin and Elshin (2019) that universities and other educational organizations “should strive for a wider use of digital technologies in their various activities in order to create a strategy of not only digital learning, but also a digital culture, and a digital educational platform that will systematically use, expand, and implement the possibilities of digital media to provide high-quality education” (p.1669).

The use of ICT is also regarded as a transformation in the Higher Education field which has had a progressive impact on the educational context. In other words, it has proposed a transformation from the conventional university with traditional educational activities and tools to the digital university through creating new learning environments in which teachers provide their students or learners with the knowledge, skills, and competences necessary to cope with the 21st century needs. As a result, this transformation has led

the university to develop a more sustainable model of education. Bansa and Asrini (2019) claim that using technology in the learning process is an integral part in learning particularly in the 21st century when learners can get engaged in “the unique technology-mediated tasks which can be used for assessment” (p.2). They also state that technology has been used “as a means of promoting the subject through project-based learning” (p.3).

Floridi (2014) claims about the advantages of ICTs which “can process information on their own, in some sense just as humans and other biological life. They can also communicate information to each other, without human intervention, but as linked processes designed by humans” (p.23). He also states that living in the loop of technology, learners can “perceive the world more and more in informational terms, and not primarily as physical entities” (p.111). He also argues that living in an infospherical world, learners become “inforgs because what is real for us is shifting from the physical and unchangeable to those things with which we can interact” (p.131). He also highlights the significant impact of integrating ICT tools in education which would help in the saving and retrieving of resources as well as the augmentation of the role of learners in the classroom. Dziuban et al. (2016) agree with Floridi (2014) and Means et al. (2013) about the valuable impact of ICTs on not only students’ success and satisfaction, but also on students’ sense of the community. They also cite what Dringus and Seagull (2015) and Bloemer and Swan (2015) state about ICTs which have led to the maximization of students’ achievement and success in their courses.

Yen et al. (2018) cite what Ngimwa (2008) claims about digital resources, as quoted below

Digital resources can therefore be seen from two perspectives: (i) the e-learning perspective which lays

emphasis on content production, collaboration, and exchange of knowledge, and (ii) the libraries' perspective which focuses on content organization, retrieval and access (Yen et al., 2018, p.2142).

They propose that both perspectives are an integral part of the provision of an adequate support to students. Makori and Mauti (2016) argue that digital technologies “have the potential to enhance the quality of learning through information and knowledge services such as e-content, e-resources, e-books, e-journals, and online databases” (p.1379).

Gautam and Sinha (2020) regard electronic resources as “a rich source of information for those students who want extra learning materials in addition to their regular classroom activities” (p.2). They agree with Adeleke and Ngoz (2017) who argue that the availability, awareness, and use of electronic resources “provide access to authoritative, reliable, and accurate access to information” (p.3).

Dziuban et al. (2016) define blended learning (BL) or hybrid learning as “the integration of face-to-face and online instruction” (p.24). Rasheed et al. (2019) regard blended learning as “an approach that combines the benefits afforded by face-to-face and online learning components” (p.2). He also adds that it is “the most effective and most popular mode of instruction adopted by educational institutions due to its perceived effectiveness in providing flexible, timely, and continuous learning” (p.4). Bosch et al. (2019) state that the concept of blended learning “is rooted in the idea that learning is a continuous process and not just a one-time event” (p.58). They argue that a single delivery mode of learning “inevitably limits the reach of a learning program or critical knowledge transfer in some form” (p.59).

Bosch et al. (2019) define blended learning as “not merely the integration of technology in the classroom or identifying the right blend of technologies to increase student access to learning opportunities, it rather requires the facilitator to create a transformative environment where critical and complex learning skills could be developed” (p.60). They claim that blended learning could “increase access and flexibility for learners, increase the level of active learning, and achieve improved student experiences and outcomes” (p.60). They also state the advantages of blended learning, as quoted below

(i) enhanced effective communication between trainers and learners; (ii) enhanced effective collaboration among students; (iii) enhanced student-centered generation of new knowledge and engagement; and (iv) an appropriate mix of technologies and learning processes. (Bosch et al., 2019, p.59)

Abaci and Quick (2020) highlight that the increasing approach of the e-textbook adoption in higher educational environments in the last decade “has sparked a corresponding interest on the efficacy and utility of e-texts for student learning and performance” (p.113). Guardia et al. (2020) highlight the advantages of e-textbooks including choice, cost, flexibility, convenience, time savings, accessibility, and environmental benefits. Moreover, Rasheed et al. (2019) claim that the process of blending instructional materials with online interventions “has proven to be an upgrade to both face-to-face traditional mode and the fully online mode of instruction” (p.3). They also add that blended learning provides “flexibility, pedagogical richness, and increase in cost effectiveness” (p.3).

Objectives of the study

The present study aims to investigate the learners' perceptions of the use of ICT tools in a blended course and their impact on their academic achievement. It also seeks to find out the different purposes of using e-resources into the classroom. It also presents the importance of the utilization of the learning management systems, particularly Moodle, in learners' academic success and development. The researcher examines the learners' end-of-course grades in the blended mode of the course, trying to make a connection between their grades and their perceptions of the characteristics of their classes as an interactive environment. In other words, it aims to analyze how learners perceive that ICT tools might contribute to the development of their skills and competences.

There has been little research on the perceptions about blended learning and the impact of using electronic resources into the classroom on the part of students. In other words, there is an observable gap in the literature about learners' perceptions of electronic resources and their impact on their academic achievement. Most studies have been done from the perspective of professionals, teachers, or librarians, but not from the perspective of learners or students. As a result, the study seeks to answer the following research questions:

1. How do learners perceive using ICT tools in undergraduate hybrid courses?
2. How does learners' use of ICT tools impact their academic achievement at college courses?

Data and Methodology

Theoretical Framework

The present study is based not only on the Constructivism theory, but also on the Uses and Gratification theory. Orús et al. (2020) state that the Constructivism theory refers to the theory of learning which regards learning as “an active process achieved by the construction of knowledge supported by meaningful contexts and social interactions” (p.3). As for the Uses and Gratification theory, it arises from the discipline of communication studies which “investigate the adoption of new types of media related to mass communication such as television and radio and their effect on individuals” (p.3). It highlights the significant role of mass communication in the learning process to the extent that students become active participants in the construction of meaning, interpretation of information, and the creation of new knowledge.

Participants

In the present study, the total number of the whole population who was enrolled in the Culture Studies course were 150. They were enrolled in their second undergraduate year in such blended course in a flipped learning environment which provides the students with a wide range of learning options. 120 students were chosen to participate in the present study because 30 students dropped out of the course at the beginning of the semester. The sample under study was divided into 60 students in the control group and 60 others in the experimental group. On the one hand, both groups received the major part of instruction in person, by attending weekly 90-minute face-to-face class meetings for 12 weeks. On the other hand, they accessed all course materials online with in-class interactive and online audio-visual supplementary materials. There was an ICT-based

programme delivered to the experimental group, who took the content of their lectures by means of additional online educational games, intelligent tutoring systems, online language resources, and audio/video platforms. The following table presents the demographic information of the participants in the study.

Table 1

Participants' demographic information

	Department	Gender
N	Language Media	Male Female
	40 80	6 114
%	33.3 66.6	5 95
Chi-square	.010	.000

As seen in Table 1, the majority of the students or respondents of the questionnaire belonged to the Media department at the College of Language and Communication at the Arab Academy for Science, Technology and Maritime Transport. 95% are female students; whereas 5% are males.

Design

The study has a quantitative and experimental design in which the researcher aims to investigate students' perceptions of ICT tools and how they are related to their academic achievement and development.

Methods

In order to collect the data, the researcher used three methods. The first method is a five-point Likert scale questionnaire which was distributed online to both groups in the present study. The questionnaire (Appendix A) was adapted from the 2018 Administration of the National Survey of Student Engagement (NSSE) which was designed to

measure whether the activities which the students engage in might be related to positive learning outcomes. It consisted of 30 question items based on students' perceptions and attitudes toward the use of ICT tools in blended courses as well as their grades in an achievement test.

After being piloted, the questionnaire was administered online in which students were required to express their perceptions and attitudes toward the use of electronic resources as well as the benefits of e-resources. They were asked to identify the frequency, factors, and functions of their use of the different e-resources at college. Moreover, they were required to identify the reasons why ICT tools would contribute to their academic development and achievement. A Chi-Square test was implemented to analyze the data obtained from the questionnaire.

The second method is an individual interview (Appendix B) which was conducted twice throughout the semester; i.e. at the beginning and in mid-semester. The interview aims at investigating the kind of progress which the students in the experimental group noticed in terms of the use of the various technological opportunities in the hybrid course.

Both control and experimental groups shared the face-to-face classes as one of the methods in the blended course. The other online method was the course textbook as well as the supplementary tasksheets. As for the intervention programme which was planned to be administered to the experimental group, it included additional online educational games, intelligent tutoring systems, e.g. chatbots, online language resources, and audio/visual platforms.

Thirdly, a pre-test as well as a post-test (Appendix C) were compared in order to determine the impact of the use of ICT tools on the students' academic achievement.

Results

Based on the results obtained from the questionnaire, more than half of the students (65%) used more than one type of e-resources in their academic courses. Approximately 54 students (90%) reported that the way in which they obtain information by means of the Internet is easy to a great extent. There was a significant relationship between students' use of ICT tools in blended courses and their preferences. 38 of all students (64%) preferred to use an e-textbook to a print textbook. 10 students (16.6%) reported that they preferred a printed textbook to an electronic one. The remaining 12 students (about 20%) have no preference. The following table presents the number, percentage, and Chi-Square results of students' use and preferences of e-resources.

Table 2

Students' use of e-resources

Question item		Very easy	Easy	Don't know	Difficult	Very difficult	
The way of obtaining information by the Internet	N	12	42	0	0	6	
	%	20	70	0	0	10	
	Chi-Square	.000					
Already used		e-textbooks	e-supplementary materials	e-activities	e-quizzes	e-learning platform	More than one source
	N	6	6	4	0	5	39
	%	10	10	6.6		8.3	65
	Chi-Square	.000					
Prefer electronic text mediums to printed ones		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
	N	0	10	12	13	25	
	%	0	16.6	20	21.6	41.6	
	Chi-Square	.000					
Read e-materials by means of.....		Desktop computer	Tablet	Smart phone	More than one device		
	N	18	3	8	31		
	%	30	5	13.3	51.6		
	Chi-Square	.000					

In the second section of the questionnaire, students were asked about the various benefits of the use of ICT tools in their classes. As shown in Table 3, 14 students (23%)

perceived that electronic resources prove to be economical as they save the cost of the printing out of course materials. 19 students (32%) perceived that ICT tools are easy to handle in terms of browsing, sharing, downloading, and interacting. 14 students (23%) reported that ICT tools are valuable aids in facilitating knowledge exchange and supporting the course content. 9 students (15%) added that the interactive features of ICT tools such as highlighting, annotation, and note-taking could be another essential advantage. There was a positive relationship between the use of ICT tools and their benefits to the information handling in courses.

Table 3
Students' perceptions of ICT benefits

	Ease of use	Cost	Facilitating knowledge	Interactive features	Ability to interact with the instructor
N	19	14	14	9	4
%	31.6	23.3	23.3	15	6.6
Chi-Square	.000				

Since students' perceptions of the use of ICT tools in their classes as well as their benefits to their academic achievement might not constitute the complete picture of the learning process in such sustainable environment in Higher Education, there were data obtained from an achievement test administered to the experimental group. By means of the correlation measurement, the results were analyzed in order to determine the relationship between the use of ICT tools and students' academic achievement. The following table presents the correlation between students' preferences of ICT tools in their classes and their academic achievement in blended courses.

Based on the results obtained from students' interviews, students assured that learning has been more than a classroom

experience. They demonstrated the coverage of technological learning facilities. For example, online resources including course textbooks were used by 88% of respondents; tutoring assistant tools, e.g. chatbots by approximately 82%; audio/visual platforms, e.g. electronic forums by 73%, and educational games by approximately 68%. This showed a high percentage of the frequency of using such electronic resources by the experimental group in the blended course, as shown in Table 4.

Table 4

Frequencies and descriptive statistics of using electronic resources

Item	N	M	SD	Use %
E-resources	60	3.52	1.2	88
Assistant tools	60	3.04	1.23	81.9
Audio/video	60	2.77	1.25	79.2
Collab. platforms	60	2.33	1.24	73.2
Games	60	2.27	1.2	67.6

The present study also draws a comparison between the grades of the students in both the control and experimental groups in the pre-test and post-test. In the pre-test, nearly 66% of all students got a B grade and about 56% got a C grade. No students got an A grade in the pre-test. In the post-test 70% of the students of the experimental group got an A grade and 30% got a B grade. This demonstrates that there is an improvement in the use of English after integrating the intervention programme in the blended course. Table 6 indicates that there is a strong correlation between the students' grades in the pre-test and post-test.

Table 5***Students' Grades in the Pre-test and Post-test***

Grade	Pre-test		Post-test	
	Control group	Experimental group	Control group	Experimental group
A (85-100)	0	0	0	42
Percentage	0	0	0	70.00
B (75-84)	14	26	30	18
Percentage	23.33	43.33	50.00	30.00
C (65-74)	24	10	12	0
Percentage	40.00	16.66	20.00	0
D (50-64)	22	24	18	0
Percentage	36.66	40.00	30.00	0
Total	60	60	60	60
Statistical measures				
Chi-Square	8.615a		4.154b	
Df	2		1	
Asymp. Sig	.013		.042	

Conclusion

In the present study, it is suggested that students' perceptions of the use of ICT tools in their classes suggest that there is a number of benefits of using these tools. Moreover, students' grades in the achievement test demonstrate the positive impact of the use of ICT tools on students' academic achievement and development. There is a major recommendation to most modern educational environments to obtain adequate information infrastructure so that it would support students' access to digital learning management systems and knowledge e-resources which would reinforce students' academic development and advancement. Based on the results which indicated a positive correlation between the integration of ICT tools in the blended course and learners' academic achievement, there could be a recommendation to further investigate the

underlying factors which might not only lead to learners' more positive perceptions of digital learning, but also implement future strategies of online learning in Higher Education institutions successfully.

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Appendix A

Questionnaire

Directions: Thank you for agreeing to take part in this questionnaire about the use and impact of e-resources in your academic courses. Please read each question carefully before you answer. The questionnaire will present a number of statements about you, your perceptions, attitudes, and learning. For each, please select the option that feels right for you for each statement. Your answers will remain confidential and anonymous.

Major field

- Language and translation
- Media

Term

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

Gender

- Male
- Female

Age

- 18-19
- 20-22

The way which I obtain information is.....

- Very easy
- easy
- difficult
- very difficult

I have used e-resources in.....

- e-textbooks
- e-supplementary materials
- e-activities
- e-quizzes
- e-learning platform
- more than one source

I have been using e-resources for.....years.

- 0-2
- 3-5
- 6-8

I prefer to use e-textbooks for.....

- Ease of use
- Cost
- Interactive features (e.g. highlighting, note taking)
- Ability to interact with the instructor
- More than one answer

I have typically used to read e-materials by means of.....

- Desktop computer
- Tablet
- Smart phone
- More than one device

I have used an e-textbook in the current academic lessons.

- Yes
- No

Converting to digital learning is.....

- Very important
- important
- not important
- waste of time
- don't know

The demand for e-resources developing in the future.....

- increase significantly
- increase a little
- stay the same
- decrease
- don't know

Please choose the option that shows how you feel about each statement

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I prefer electronic text mediums to printed ones.					
I am satisfied with e-text feature uses such as page views and annotations.					
I know different types of e-resources.					
I use the internet in the learning materials.					
I am satisfied with the use of e-resources in college courses.					
I am the right type of person for electronic resources.					
I am interested to read the electronic materials which the instructor refers to if it is included in the exam.					
I am interested to read the electronic materials which the instructor refers to even if it is not included in the exam.					
I am interested in electronic lectures in the form of slides.					
I am interested in electronic audio-visual materials such as audios, videos, and films.					
The instructor makes learning fun by using e-resources.					
The instructor gives help when students need it by means of the online learning platform.					
The instructor integrates e-textbook activities for his/her lessons.					
The instructor provides highlights and annotations in the e-textbook.					
The instructor prefers to use printed book materials for on-campus classes.					
The instructor prefers to use electronic materials for online classes.					
The instructor uses communication activities and internet-based materials such as pictures, posters, videos, audio recordings, and films.					
I prefer to use the e-textbook format for all courses in the future.					
I prefer to convert the forms of assessment from paper-based quizzes to online ones.					

Appendix B

Individual Interviews (Beginning of semester)

1. How many years have you been learning English?
2. Could you describe your methods for learning at college?
3. How do you define “success” in a course?
4. What do you consider the characteristics of a good student or learner?
5. Do you think there might be any difference between learning online and learning in face-to-face classes?
6. In which environment – face-to-face or online – do you feel that you can learn better? Why?
7. What challenges / problems / difficulties do you anticipate in your online classes during this semester?

Individual Interviews (Midterm)

1. How is your learning progressing so far?
2. Could you describe how you managed your study?
3. How have you utilized the available tools and resources to study?
4. How do you feel about their usefulness to you so far?
5. What progress do you think you have made during the past few weeks?

Appendix C

Achievement exam

Correct the mistake in the following statements.

1. The dimension of individualism refers to the level of stress in a society in the face of an unknown future.
2. Small power distance is evident when parents teach their children obedience and respect.
3. Indulgence means that people are born into extended families or clans which protect them in exchange for loyalty.
4. Gender stratification can be defined as the way in which masculinities and femininities are acted out.
5. Bullfighting in Spain is an example of the totality of ideas related to the construction of femininity.
6. Unlike patriarchy, sexism is a form of social organization in which men dominate, oppress and exploit women.
7. Ethnicity refers to a category of people who share biologically transmitted traits that members of society deem socially dominant.
8. The connotative meaning of a word is the dictionary style of meaning with all its associations.
9. According to Maslow's hierarchy of needs, belonging and love needs come first then other physiological needs.
10. Genocide always happens suddenly without planning.
11. Gender stratification is a society's equal distribution of wealth, power, and privilege between the sexes.

12. Rugby in Tonga is an example of power distance in that community.
13. Unlike sexism, patriarchy is the belief that one sex is innately superior to the other.
14. Large power distance is evident when old people are neither respected nor feared.
15. Collectivism means that everyone is supposed to take care of him- or herself and his / her family only.
16. Racism refers to a category of people who share their cultural and historical heritage.
17. The denotative meaning of a word is the interpretive style of meaning with its cultural associations.
18. The connotative meaning of a word is the dictionary style of meaning with all its associations.
19. Intra-cultural communication is a cultural dimension that highlights to what extent a society focuses on the future or on its past.
20. A democratic system is a political system that depends on total control, brainwashing and worship of its leader.