

Designing An Adaptive Environment Based On Artificial Intelligence Applications To Develop The Gifted Students' Digital Skills: A Proposed Perception In Light Of Reality And Needs

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Abstract

The study aimed to design a proposed perception for an adaptive environment based on artificial intelligence to develop digital skills in gifted students through using such skills at the intermediate level in the Ihsa governorate. It also aims to identify the most important necessities teachers need to develop these skills in the gifted.

To achieve the objectives of the study, the researchers adopted the mixed approach (the concurrent design), where the quantitative (the survey descriptive) and the qualitative (A multi-case study) were applied. The qualitative sample comprised (4) teachers, two males and two females, who teach digital skills to the gifted at the intermediate level and scale up the level of learners.

(Velarde, 2019) indicated that the revolution had created a new age of education in which the term "Artificial Intelligence" and its applications were the foremost components of the age. (Chen, 2020) confirmed that artificial intelligence was a fertile field that included inventions that mimic the human mind. Cognitive capabilities, learning, adaptation capability, and decision-making characterize it. Using artificial education in the educational field is important for modern cognitive development, particularly developing the basic skills for building a cognitive community. The countries that rely on cognitive economy vie for using it to achieve a positive impact in all fields of human life in the long run.

The study results unveiled that the necessities (Technical, material, developmental, enrichment, guidance, and moral) were needed for digital technology teachers to develop digital skills in the gifted. Afterward, the researchers put down their proposed perception, which included: the idea, philosophy, significance, objectives, and steps of application and evaluation. They concluded the study with a set of recommendations.

Keywords: Adaptive environment; Artificial intelligence application; Digital skills; Proposed perception; The gifted

Introduction

World scientific and technical development has shown an unprecedented quantum leap in various fields of life. This development was distinguished for tremendous acceleration and the huge potential that facilitated life needs and transactions and had never been witnessed before. The industrial revolution went through numerous stages until it reached the so-called fourth industrial revolution. Naturally, the education field was one of the foremost among those affecting and are affected by this overwhelming revolution.

(Prisecaru, 2016; Hirschi, 2018) Both confirmed that the fourth industrial revolution has directly affected all fields of life, including inputs and outputs of education, in an integrated manner.

As for the quantitative sample, it comprised (185) male, and gifted female students, (86) were males; and (99) were females. The researchers also used quasi-structured interviews and a tool to measure digital skills. The validity and reliability of the tools were verified by using several methods.

The study revealed that using the following skills rated “Low” those were: digital self-shopping, infographics, design, and cloud-computing applications via Google. As for using teamwork skills, they rated “Medium,” while using digital-self learning rated “High.”

Due to the positive impacts of the gifted on their society, they became the major concern of developed countries’ policies. So, educating them dictated meeting their different needs, developing their capabilities, and providing them with all that supports them. Thus, artificial intelligence imposed itself on education in general and that of the gifted in particular. (Hye, 2020) confirmed that the gifted could easily adapt to the fourth industrial revolution, but that dictated building an educational environment with multi-level and qualitative requirements to educate them to achieve their objectives.

In response to the tremendous development in the field of education and the tendency to activate the role of artificial intelligence in teaching the gifted, creating an adaptive environment based on applications of artificial intelligence became urgent, as such an environment positively affects the human product in and outside the domain of education. (Velarde, 2019) pointed out

that intelligent devices and technologies help create an intelligence learning environment that effectively enhances personal learning and adaptive education in a way that accelerates merging them.

Because digital skills constitute the basic process by which the adaptive environment that meets the requirement of that age rest. (Christine, et. al., 2012) assured that the individual's ability to compete comes from possessing high skills in technology. (Bergdahi, 2019) several studies found that students' level of digital skills and the degree of participation in the learning enhanced by technology directly correlates with their levels and learning outcomes. (Velarde, 2019) noted that artificial intelligence applications with relevant digital skills aimed to switch from an electronic learning environment to an intelligence counterpart that meets an individual's needs. It is also noted that achieving this development in the educational process, besides students possessing satisfactory and practical skills in the technology field, depends on artificial intelligence applications that facilitate learning, improve performance, and create a special, adaptive participative environment in which the students themselves.

Given the above, one can say that tackling adaptive environment, artificial intelligence, and digital skills and relating that to the gifted through documented studies suit global trends to achieve the now- and- future needs through studies and research works that support education in general, and the gifted in particular.

Statement of the problem

Teaching the gifted, in a way propitious to their abilities, needs, and societal aspirations, is an accumulative process that holds a set of challenges and hopes. Therefore, the process of teaching them should be resilient to the extent of coping with life updates. The essence of gifted active programming lies in integrating advanced curricula with active teaching strategies which reinforce the gifted learning outcomes (Callahan, et al., 2015). The National Association for Gifted Children (NAGC) (2019) emphasizes providing the gifted with learning opportunities and various modern technology programming options.

It is worth mentioning that both teaching and artificial intelligence contribute to developing gifted student skills; the former develops students' knowledge, while the latter helps provide the tools needed for that development (Manie et al., 2020). (Laar, et al., 2017) indicated that digital skills in innovation and competition were first in the 21st century. They are also considered the foremost skills that the gifted need throughout life. (Huang, 2015) considered acquiring such skills a decisive factor for the future success of the gifted. (Dawn, 2018) assured that it was necessary to understand students' perceptions regarding digital skills applications and the obstacles that might hinder using them, as perceived by the students themselves.

Developed countries tend to include technological and digital skills related to gifted students regarding curriculum, activities, competitions, and enrichment programs (Qahtani,2023). Several studies emphasized the need for learners to acquire digital skills, as cloud computing was the foremost of such skills because it utilized learners' efforts away from time and place (Safasfi & Ajlouni, 2018; Suleiman, 2021).

Digital marketing skills occupied and advanced the level of digital technology skills. Several studies, like those of (Andrew et al.,2018; Diyasti,2020), emphasized the importance of such skills and the need to gear curricula toward them. Qahtani (2023) highlighted the significance of entrepreneurship for building a future career for the gifted. Such an opinion was supported by the (2030) vision, which considers digital marketing one of the student's skills for entrepreneurship. Hilali (2020) emphasized that participative teamwork provides students with in-depth knowledge and is one of the pillars of modern learning. (Mahmoud, et al., 2020) also noted that working with a team using digital technical devices achieved greater social interaction, besides the mental development of students. (Hadeedi, 2021; Jundi,2022) both unveiled Infographics applications' role in teaching-learning.

To have a more comprehensive picture, the researchers tried to identify the most important needs that teachers of digital technology find necessary for their students. Such an issue was lacking in Arabic and foreign studies. The variance among trends and interests of the gifted, even in the same group, reflects differences concerning their scientific mental abilities in a specific scientific field. (Sternberg, 2018) v. Therefore, creating an adaptive environment based on artificial intelligence constituted an important tributary and fertile soil for developing gifted digital skills. (Yang, et al., 2013) reported that the adaptive environment benefited from various technologies that proved effective in the setting of various classrooms.

Due to the rare Arabic and foreign studies that tackled the issue, and based on the researchers' belief in the importance of developing gifted skills to cope with future requirements, the lack of creating an adaptive environment based on artificial intelligence applications that supported digital skills and were assured through the initial simplified classrooms in the governorate, and, finally, determining the foremost necessities the teachers need to develop gifted digital skills. The necessity to create a proposed perception of an adaptive environment based on artificial intelligence applications that support digital skills and meet teachers' needs emerged. The study by (Harbi, 2022) recommended designing technological and electronic programs that care for the gifted in Saudi Arabia in several specializations.

However, the statement of the program lies in identifying the status of using digital skills by gifted students and teachers to develop such skills in those students. This will be the foundation for designing a proposed perception of an adaptive environment based on artificial intelligence that develops digital skills in intermediate-level students.

Questions of the study

These might be outlined in the following:

- 1- What is the status of using digital skills by gifted intermediate–level students at Ihsa governorate?
- 2- What are the main necessities teachers need to develop digital skills in gifted students at Ihsa governorate?
- 3- What is the perception proposed to design an adaptive environment based on artificial intelligence to develop digital skills in gifted students?

Significance of the study

The following points shed light on this significance:

- 1- It is expected that the results of this study might help planners and those concerned with curricula in developing plans following modern scientific trends.
- 2- It is also expected that the proposed perception for designing an adaptive environment based on artificial intelligence applications provides a better opportunity for the gifted to develop their digital skills to advanced levels.
- 3- The study will enrich the Arabic library in the field of gifted digital skills and the adaptive environment that supports the implementation of such skills.
- 4- The study will also provide a new perception of the participative adaptive environment, which will be a significant addition to educating the gifted and a helping tool for the application in relevant classrooms.

Study terminology

- The gifted: The American Federal Bureau for gifted children defines them as: “the children, who are identified, by professionally qualified people, to be distinguished for outstanding ability and high performance. Such children need distinctive programs and services better than ordinary school programs. The children with high performance include those with distinct accomplishments or potentials in the following fields: general mental ability, certain academic readiness, productive or innovative thinking, leadership ability, performative and visual arts, and psychomotor ability.
- Procedural definition of the gifted: These students passed the multiple-mental ability scale test administered by “Mawhiba.”
- Adaptive environment: it is an interactive environment that can change the method of presenting learning content by adapting the learning environment in compliance with programming and applications of artificial intelligence that provide the educational material in a method propitious to education preferences and gifted needs (Mahmadi,2020). Procedurally, the researchers define it as an integrative process of factors and procedures that can be generally achieved in the learning place and extends beyond learning as needed. It should contain elements that could create a propitious interaction between the student and learning that gets along with the needs and requirements of the age. This

could be achieved within a common framework that produces an outstanding product.

- Artificial intelligence: It is a computer-controlled device that performs tasks semi-humanly (Goskel & Bozkurt, 2019). the device is used, at a wide scale, in some technologies such as smartphones, the internet, research drives, and applications (Fahmirad & Kotamaji, 2019). Procedurally, the researchers define it as the artificial intelligence application used for designing the proposed adaptive environment.
- Digital skills: They facilitate comprehending and using information in various forms from a large group of resources that the computer provides (Turner, 2014). It is noted that the definitions of digital skills focus on the ability to use the computer and its applications.

Procedurally, the researchers define it as the score the gifted students gain according to the measurement device of digital skills.

Theoretical framework and previous studies

First: Adaptive environments. The need for adaptive educational environments appeared because of some shortcomings of the non-adaptive electronic educational environments, whose first objective was to develop the cognitive side at the expense of skills without considering individual differences of learners.

Adaptive environments of education are considered one of the artificial intelligence types that suit the gifted needs, refining their cognitive and behavioral skills. Such environments are the focal point of interest for the gifted because of the excitement and challenge they provide for mental skills and abilities (Zimlich, 2015). Azmi & Mohammadi (2017) pointed out that the environments are one of the types of electronic education characterized by being flexible and dynamic to develop cognitive experiences in compliance with pre-determined standards.

Significance of the adaptive environment in teaching the gifted

Adaptive environments have several characteristics that make them essential for teaching the gifted. The most important is the ability to present content in various methods based on interactive factors, which help adapt learning environments to artificial intelligence to meet the different cognitive needs of the gifted. They even go further to a higher level of evaluating the abilities of the gifted and determining the propitious tracks of special education (Hijazi, 2015; Muhammadi, 2020; Clemens & Izumi, 2013).

In addition to the above, adaptive environments based on artificial intelligence play an important role in teaching and caring for the gifted, manifested in developing several cognitive and personal abilities. For example, they augment motivation, self-learning, developing thinking skills, and building a creative personality that facilitates individual learning activity (Shukhman et al., 2018; Kim & Jeon, 2018; Jureiwi, 2020). The study by (Ghamdi & Abbasi,

2022) recommended introducing smart environments, based on artificial intelligence, to gifted teaching due to their active role in the teaching-learning process.

Second: Digital skills

Digital skills are generally considered one of the most important requirements for learning and the labor market. These skills have three levels: primary, medium, and advanced. The levels enable students to deal with the one that suits their different mental abilities, inclinations, and readiness. The gifted group is the one that most needs to deal with technology to delve into knowledge and information from various sources and aspects of difference and similarity. To cope with the development of skills in the 21st century, the technological skills of the gifted should be developed to enable them to adapt to future work environments in light of artificial intelligence and constant technological development (Zimlich, 2015; Jena, 2018; Dobre, 2015).

Importance of digital skills in teaching the gifted

Digital skills greatly help learners because they satisfy students' needs. They also support rational thinking and develop creativity (Abu Almajd & Arfaj, 2017). Concerning the gifted, digital skills actively help creative thinking, critique, and problem-solving. Scientific enrichment of the gifted learner is induced by social media and dealing with digital technology (NAGC, 2010).

Digital skills include a set of skills through which the student can produce digital media, process and retrieve information, and share social networks by which he can exchange ideas in actual practice. Although the studies handling such skills were rare, they disclosed their importance to students. The researchers see that these skills might be outlined in the following:

Infographic design skill: It is the art of transforming images that learners can comprehend (Toth, 2013). Using this skill in personal learning environments positively develops cognitive achievement in the student. It also develops the digital citizenship concept and website design skills (Hassounah, 2017; Taha et al., 2022; Husein, 2021).

- Digital self-marketing skill: It is a way of self-reliance learning in which the learner controls his wishes and trends. It also enhances cognitive abilities, especially for the gifted. Achieving self-learning rests on a group of personal factors besides the positive use of technology (Jaser, 2019; Zahrani, 2019; Zubeidi & Hebshi, 2019).

Cloud-computing application skills via Google

This type of technology provides computer sources that benefit internet users needing cognitive reference or experience (Khafaji, 2010). Many organizations adopt cloud computing by using virtual sources through the internet, which

might substitute educational organizations (Ercan, 2010). Zahrani (2019) confirms that cloud computing helps develop innovative thinking because such applications help create participative groups through which students can exchange ideas to attain a certain goal. The studies by (Muteiri, 2015; Safasfeh & Ajlouni, 2018) assure that using cloud computing in teaching environments reinforces teaching activities, besides students' motivation for learning and problem-solving skills.

Work skills within the Internet team

It is the mental and emotional skill that the learner quickly and accurately does by using cooperative learning, conversation method, and team stance through the internet (Hasan, 2018). This skill enables students to interact positively with small groups studying specific content. It also allows students to share ideas and examine attitudes suggested by team members. This skill relies on learners' responsibility, cognitive progress, and contribution to work achievement. Thus, cooperation among group members is the major component of this skill (Tandarawi & Mohammed, 2021; Salameh, 2020).

Second: Applications of Artificial intelligence on developing digital skills

The applications in a virtual environment have three types: first, the tutor type for every learner, which employs e-learning through self-training logarithms and neural networks. This type aims to come to propitious decisions that suit academic content. The second type is smart, collaborative learning through which an adaptive environment is formed and uses artificial intelligence to collect data about the participating learners from whom the convenient group is selected to reach the specific objective in advance. The last type is smart virtual reality, by which the learner can interact with several procedures more realistically, and that helps him produce new ideas (Pathak, 2014; Mariuz, 2017; Hill & Barber, 2016).

Thus, artificial intelligence is considered one of the important applicable factors to the education environment in general; it helps determine the learner's level and examine learning steps starting with the planning stage through the design and implementation stages ending with the evaluation stage. It plays the role of the teacher in providing answers and queries to learners: It is also capable of making decisions that suit the learner's potential by analyzing the learner's case, situation, and content (Bisher, 2020).

Hence, the importance of artificial intelligence applications lies in developing the cognitive and performative sides of gifted students. They also bridge the spatial gap between them by communicating with each other and educational institutions. They provide opportunities for free discussions, opinion expressing, choosing appropriate teaching strategies, and matching learning time with learners' conditions. But there might be numerous challenges that face the activation of artificial intelligence in students' enrichment programs, the foremost of which might be a lack of motivation to activate artificial intelligence

applications, the absence of a guide that explains how to activate the applications, and absence of training on how to use them (Muhmmadi, 2020; Jamaan, 2019; Ghamdi & Abbasi, 2022).

Fourth: Needs of teachers of the gifted to develop digital skills:

Although digital skills are important for gifted students, there are still several challenges that face gifted teachers in developing such skills. Therefore, developing them in students requires achieving numerous needs that help the teacher in this respect. Among such needs are: restricted access to the internet, limited technical support, and computer shortage. In addition, providing e-platforms supports the gifted in exchanging experiences among themselves. Thus, infrastructure with its constituents helps gifted teachers develop digital skills (Rayyan, 2016; Baqyeh, 2016; Musa & Asadi, 2016; Ozcna & Bicen, 2016).

On the other hand, there is still another challenge that might be the most important for developing the skills; it is the lack of teachers' professional development in light of constant technological changes in information technology. Lack of knowledge in this field also hinders the development of digital skills, and that dictates holding training courses to qualify teachers (Diab & Broice, 2019; Ramasam, 2019; Ghavifekr et al., 2016; Mukalele & Antony, 2016).

Study methodology

To achieve the objectives of the study, the mixed method, which combines the quantitative approach (the descriptive survey) and the qualitative (case study), was adopted. The first, the quantitative, was used to answer the first question, while the second, the qualitative, was used to answer the second question. Answers to these two questions help answer the third one. (Creswell & Clark, 2014) noted that this mixed approach is used because it provides an understanding of the problem better than what the other two approaches do separately.

Researchers used the Concurrent Embedded Design to collect data, but they gave more weight to one of the approaches over others (Creswell, 2007).

Although the qualitative and quantitative data were collected simultaneously, the quantitative was embedded in the qualitative one, and consequently, study priority was given to the mixed at the qualitative stage.

Study population:

The population comprised (4) male teachers and (7) females, who taught the gifted at the intermediate level, and students of the two sexes who passed the giftedness test at the Ihsa governorate. They amounted to (855) students: (380) males and (475) females.

Study sample:

The qualitative sample comprised (2) male teachers and (2) female teachers of those who taught digital skills to the gifted at the intermediate level.

As for the quantitative sample, its percentage was (21%) of the study population. It comprised (185) gifted students of the intermediate level, (86) males and (99) females.

Specifications of the qualitative sample

Participating teachers in this study were selected by the convenience method through contacts with the gifted administration. Schools of the gifted were contacted to select many digital-skill teachers who were willing to participate. The total number of participants was (4), two male teachers and two females. Table (1) provides basic data about teachers without reference to names for confidentiality. A code comprising a letter and number was used to refer to the teacher (T) stands for teacher, and the number for the serial number in the table of qualitative data analysis.

Table (1): Basic data of teachers participating in the study

Teacher's code	Qualification	Specialization	Total years of experience
T(1)	B.A	Computer	Nine years
T(2)	B.A	Computer	11 years
T (3)	B.A	Computer	Five years
T (4)	B.A	Computer	20 years

Collecting and analyzing qualitative data

Study qualitative tool

To collect data from participants, the researchers used the Semi-structured Interview Method because it was the optimal way by which they could get actual knowledge, the natural way, concerning subjects (Pazsoldan, et al., 2014). This method was based on addressing major and secondary open-ended questions. The questions were arranged in a way that could help get comprehensive information about the participants. The study questions were divided into two sections: the first was on teacher's basic data (qualification, specialization); the second comprised questions of the semi-structured interview, which were outlined in the following:

- What are the obstacles that might stand in the way of achieving the need for developing digital skills in gifted students at the intermediate stage?
- What do you do to achieve your needs for developing digital skills in the gifted in light of the challenges that face students and educational environments?
- To what extent did modern technology and education development help you get your needs to develop digital skills in the gifted students?

- How do you describe the correlation between your needs for developing the skills and the educational reality of the semester?
- From your point of view, what are the needs common between you and your teachers regarding developing skills in the gifted?
- Are there points you would like to mention about developing digital skills among gifted students that have not been addressed?

Methods of analysis

The qualitative data (semi-structured interviews) were analyzed inductively, starting with the minor subjects and moving to the pivotal ones, as reflected in the study results. Table (2) presents the stages of the analysis.

Table (2): Stages and procedures of qualitative data analysis

No.	Stage	Procedures
1-	Data organizing	At this stage, the data collected via the semi-structured interviews by voice recording were dumped, then written down in Word documents, and missing information was recovered by checking hand-written observations on the interviews. Finally, the written document was edited for errors.
2-	Data coding and classification	The researchers used the rooted theory approach adopting its coding stages, of which the first two sufficed, as they suited the nature of the data that were collected and the objectives specified through the following stages: First: open coding. This was done by analyzing and coding sentences, and words stated in the written interviews, giving them short titles. Second: Axial coding. After the open coding, similar symbols were gathered and classified into axial categories, including the foremost needs teachers of digital skills need to develop in gifted students (Vollsted & Rezat, 2019).
3-	Data examining	Work was done by two teams, each of which comprised two researchers. Each team coded every interview. After completion of the work, the two teams met to agree on a common coding between them. In the event of a discrepancy, they resort to an external arbitrator.

- Data collection and validity verification: A questionnaire was designed to collect data from the study sample, a tool to measure digital skills. The purpose was to identify the extent to which the gifted students of the intermediate level used the specified digital skills. The tool comprised (31) items divided into (5) dimensions as follows: Infographics design (8) items (1-8), digital self-marketing skills (8) items (9-16), digital self-learning skills (5) items (17-21), cloud computing skills via Google, (5) items (22-26), and finally, online team working skills (5) items (27-31). The skills were divided into three levels: basic skills, which include (cloud computing skills via Google and digital self-learning skills; medium skills, which include (digital self-marketing skills, online team working skills, and

infographic design skills); advanced skills, which include (website design). The questionnaire used Likert's five-point scale (very high=5, high= 4, medium= 3, low= 2, and very low= 1).

The tool was designed based on the previous studies and the theoretical literature, the two researchers built the tool of the study.

Study limitations:

These were:

- Object limitations: A proposed perception for designing a participative adaptive environment based on artificial intelligence applications to develop digital skills in gifted- intermediate level classes.
- Human limitations: The study was limited to male and female gifted students who passed the giftedness intermediate level scale test in schools of Ihsa governorate; the total number was (855) male and female students.
- Time limitations: Third academic semester 2022/1443 A.H.
- Space limitations: Intermediate-level schools of Ihsa governorate.

Reliability:

- Trustees` reliability: The digital skills tool was sent to (6) trustees specialized in special education, computer, and education technology. The arbitration involved the following aspects: items relating to the dimensions and appropriate language use. Some items were modified accordingly.

Factor reliability

The following table (3) elucidates that.

Table (3): Factor correlation to item scale

Factor	The strongest variable correlating to the dimension	The weakest variable correlating to dimensions	Items
First	(34) (0.90)	(37) (0.77)	34, 32, 33, 36, 35, 30, 31, 37
Second	(16) (0.78)	(21) (0.32)	16, 18, 20, 19, 14, 15, 17, 21
Third	(11) (0.79)	(12) (0.59)	11, 10, 8, 9, 12
Fourth	(6) (0.82)	(4) (0.42)	6, 7, 2, 3, 4
Fifth	(22) (0.67)	(24) (0.47)	22, 26, 28, 27, 24

Reliability of Internal Consistency

To verify the reliability of the internal consistency of the tool, Pearson Correlation Coefficient was used to measure the relationship between every

item and the total score to which it belongs, in addition to the relationship between the item and the total score of the tool. The results are presented in Table (4) as follows:

Table (4): Correlation coefficients of each item to its total score

Domain	Item	Correlation Coefficient	Item	Correlation Coefficient
Infographic Design Skills	1	0.818**	5	0.916**
	2	0.859**	6	0.880**
	3	0.882**	7	0.853**
	4	0.860**	8	0.787**
Digital self-marketing skills	9	0.727**	13	0.751**
	10	0.677**	14	0.716**
	11	0.698**	15	0.760**
	12	0.679**	16	0.679**
Self-Learning Digital skills	17	0.762**	20	0.783**
	18	0.790**	21	0.721**
	19	0.752**	25	0.802**
Online Cloud Computing Skills	22	0.806**	26	0.814**
	23	0.786**		
	24	0.686**		
Online Teamworking Skills	27	0.577**	30	0.802**
	28	0.720**	31	0.728**
	29	0.786**		

**Functional at (0.01)

Table (4) reveals that all correlation coefficients between every item and the dimension to which it belongs were positive and statistically significant at the function level (0.01).

The following table (5) presents the correlation coefficient of every dimension to the total score of the questionnaire.

Table (5): Correlation coefficients of each dimension to the total score of the questionnaire

Dimension	Correlation
Infographic design skills	0.772**
Digital self-marketing skills	0.823**
Digital self-learning skills	0.642**
Cloud computing applications skills via Google	0.536**
Online team working skills	0.648**

**Functional at (0.01)

Table (5) shows that the correlation coefficients of each dimension to the total score of the questionnaire were positive and statistically functional at the level

(0.01). This proves that all questionnaire items were valid to measure the objective for which they were designed.

Reliability

To verify the reliability of the questionnaire, Cronbach's Alpha Coefficient was used to measure the tool's dimensions. The results are presented in Table (6) as follows:

Table (6): Reliability coefficient values of the tool's dimensions

Dimension	Cronbach alpha coefficient	Half split
Infographic design skills	0.948	0.938
Digital self-marketing skills	0.859	0.840
Digital self-learning skills	0.809	0.834
Cloud computing applications via Google	0.838	0.735
Online team working skills	0.746	0.745
Questionnaire as a whole	0.921	0.739

Table (6) reveals that values of Cronbach alpha of tool dimensions are high, which assures that the tool enjoys a high level of reliability.

Study results

- Answers and discussion of the first question:

In answering the first question, which reads: "What is the reality of using digital skills by gifted students of the intermediate level?", arithmetic means, and standard deviations were computed for sample members' responses. The following is a detailed presentation of the reality of the gifted students' use of digital skills.

- Infographic design skills

To identify the reality of using these skills, arithmetic means, and deviations for responses of sample members regarding the items linked to this dimension were computed. The following table (7) elucidates that.

Table (7): Means and deviations for responses of sample members on the reality of using infographic design skills by the students

No.	Item	Mean	Std	Degree use	Rank
2	I can design a poster to present my ideas to others by using Infographics.	2.61	0.802	Medium	2
4	I can choose a suitable font for infographic design.	2.44	0.802	Low	4
3	I can present infographics in a clear, attractive shape.	2.37	0.807	Low	3

1	I can design resumes by using Infographics.	2.19	0.820	Low	1
6	I can design Infographics in clear, detailed drawings.	1.94	0.772	Low	6
8	Infographics help me to utilize old knowledge in new experiences.	1.91	0.737	Low	8
5	I can design Infographics where texts integrate with drawings.	1.85	0.714	Low	5
7	I can design mobile Infographics propitious for the presented amount of information.	1.81	0.720	Low	7
	General mean	2.14	0.678	Low	

The table also shows that the means of all items was (2.14) with a low rank use. This reveals that using skills of Infographic design by the gifted students was low.

To the knowledge of researchers, no scientific studies tackled the issue of the extent of Infographics use the gifted students have. Such a thing encouraged the researchers to discuss this issue in the current study. Nahar (2019) pointed out that presenting ideas through Infographics is a means that facilitates transferring complicated ideas in an attractive clear manner. It is also an easy means for disseminating ideas through social media.

In addition, Madqoor & Azab, (2018) noted that Infographics assist in innovatively presenting ideas. It also retains educational content and concentration. Due to the low rank of the Infographic design skills gained, it should be included in the adaptive environment the study proposed.

Digital self-marketing skills

To identify the use of these skills by the gifted students means and deviations for responses of the sample study were computed. The results are presented in the following table (8).

Table (8): Means and deviations for responses of study sample members regarding digital self-marketing use by gifted students.

No.	Item	Mean	Std	Degree of use	Rank
9	I can convey my ideas to others clearly via social media.	2.58	0.926	Low	1
14	I use my skills to communicate with others via social media to exchange ideas.	2.55	0.828	Low	2
16	I can present my ideas in attractive designs via the Internet.	2.51	0.860	Low	3
10	I can attractively present my ideas through images, sound, and drawings via social media.	2.45	0.847	Low	4
12	I use statements that attract the attention of others on social media.	2.42	0.798	Low	5

11	I can influence social media.	2.39	0.776	Low	6
13	I can market my skills on social media.	1.78	0.789	Very low	7
15	I can train others on the skills I have through social media.	1.61	0.831	Low	8
	General mean	2.29	0.749	Low	

The table also reveals that the mean for all items was (2.29) with a low score which indicates that using digital self-marketing skills by gifted students was low.

To the researchers' knowledge, there were no studies on gifted students' digital marketing skills. They have creative ideas and projects reflected by participating in local and international contests. For example, the Science, Technology, Engineering, and Mathematics (STEM) programs don't have any marketing plans to benefit from, as the study by (Diasti, 2020) revealed. The study by (Yahyaieia, et al., 2019) also revealed that the gifted need skills based on self-marketing, which enable them to present their ideas, skills, and talents that distinguish them from others. Given the preceding, the researchers see that digital self-marketing skills should be developed in the gifted to market their ideas and inventions to benefit from them financially or otherwise.

Digital self-learning skills

To identify the reality of using these skills by the gifted students means and deviations for responses of sample members were computed. The following table (9) elucidates that.

Table (9): Means and deviations for sample member responses of using digital self-learning skills by the gifted

No.	Item	Mean	Std	Degree of use	Rank
17	I can get information from various sources via the Internet.	3.61	0.629	High	1
18	I can decide on the knowledge for acquiring new skills via the Internet.	3.58	0.776	High	2
19	I can acquire new skills and self-learning via the Internet.	3.51	0.724	High	3
20	I can expand, through the internet, in the scientific domain of my preference.	3.48	0.699	High	4
21	I can solve the problems I encounter by using the internet.	2.89	0.828	High	5
	General mean	3.41	0.565	High	

The table also unveils that items generally got a "medium" mean (3.41) with a high rank of use.

The results of the current study agree with those by (Zahrani, 2019), which concluded that the trend of gifted students at the intermediate level toward self-learning was high. Moreover, the study by (Zubeidi & Hibshi, 2019) revealed that the trends of the gifted toward self-learning via the Internet were positive. But results of this study disagree with those of the study by (Rashidee, 2014), which concluded that learning such skill ranked “medium”.

The researchers attribute such a difference to the difference in the sub-skills of the two studies. They also see that the high rank of the current study might be attributed to the readiness of the gifted toward self-learning, which might develop digitally. The researchers also believe that the high ranking of self-learning skills contributes to the interest in the adaptive environment, as it anticipates the success of the environment based on artificial intelligence applications. Such an environment reflects the student’s ability to learn digitally whenever the supportive educational environment is secured.

Applications of cloud computing skills via Google

To identify the reality of using these applications by the gifted means and deviations in sample members’ responses were calculated. The results are presented in the following table (10).

Table (10): Means and deviations of sample members’ responses regarding using applications of cloud computing skills by the gifted

No.	Item	Mean	Std	Degree of use	Rank
25	I use Google Drive to upload my folders and download multimedia (images, sounds, videos).	2.61	0.803	Medium	1
22	I use Google Documents to create, edit, and share documents.	2.49	0.748	Low	2
23	I use Google Slides to create presentations.	2.32	0.861	Low	3
24	I use Google Forms to collect data from others and benefit from them.	2.25	0.719	Low	4
26	I use Google Drive to share folders with others.	2.16	0.724	Low	5
	General mean	2.37	0.634	Low	

The table also reveals that the overall mean of the items was (2.37) with a “low” rank indicating that the gifted students’ use of cloud computing application skills via Google was low. To the researchers’ knowledge, no studies were conducted on the issue. However, the current generation is of the technological type, so they need the skills to keep pace with technology such as cloud computing, which will greatly benefit them because it makes the learning process more interactive (Zahrani, 2019).

The study by (Kumar & Sharma, 2021) proved that cloud computing applications make students more resilient concerning the time and space they opt for. They increase interest in learning, creativity, and innovation and

enhance learning with peers. The study by (Safasfi & Ajlouni, 2018) added that the applications provide principles of mimicry, resilience, and interaction with sources of learning. Therefore, they provide learners with creative tools, motivate innovation, and correlate the tools to past experiences, utilizing them for problem-solving.

The researchers see that possessing cloud computing skills by gifted students at the intermediate level is very important because they broaden the scope of learning sources. In addition, some skills help the gifted present information or ideas they have about Google Slides and Google site applications and share that with others via Google Drive and Google Mee.

Online team working skills:

Deviations for sample members' responses were computed to identify the reality of using online team working skills by the gifted means. The results are presented in Table (11).

Table (11): Means and deviations for sample members' responses to the gifted use of online teamwork

No.	Item	Mean	Std	Degree of use	Rank
30	I respect the opinions of online team members	2.91	0.980	Medium	1
28	I offer assistance to others via the Internet.	2.87	1.092	Medium	2
29	I offer assistance to others via the Internet.	2.81	0.931		3
31	I can manage dialogue and organize ideas for online teamwork.	2.64	0.867	Medium	4
27	I prefer to work with an online team than separately.	2.51	1.091	Low	5
	General mean	2.75	0.814	Medium	

Item (27), which reads, "I prefer to work with an online team over working alone, ranked "low" with the lowest mean (2.51). The table also disclosed that the general mean ranked "medium" with (2.75) value. Such a thing reveals that these skills with the medium rank need support. To the researchers' knowledge, no studies tackled the issue of gifted students' possession of teamwork skills via the Internet. Therefore, they see that the reason behind the inclusion of this skill is the negative impact that e-learning might leave on the student in isolation from others, thus losing the element of interaction with peers. Moreover, gifted students at the intermediate level have some traits that distinguish them from other age groups due to the sensitivity of the adolescent age. (Qureiti, 2014) confirmed that some gifted students might live in their world without creating positive social relations with others. Hence, the researchers see that including such skills in the proposed adaptive environment is important. (Dandarawi & Mohammed, 2021) and (Salamah, 2020) both pointed out that these skills allow

the students to share ideas presented by team members, thus allowing them to present different points of view on a certain subject.

The study by (Besnoy, 2021) indicated that to help the gifted succeed after the secondary stage, their teachers need to create a digital academic environment where they can use such skills in collaboration with others, selecting sources from the internet and publishing what they have through social media. Therefore, researchers emphasize the importance of an adaptive environment based on artificial intelligence applications to develop digital skills in gifted students.

Answering and discussing the second question:

The following table (12) presents the results of answering the second question, which reads, “What are the main necessities that teachers need to develop digital skills in gifted students at Ihsa governorate?”

Table (12): Teachers’ needs to develop digital skills in gifted students

Categories	Major topics	Secondary topics
Teachers’ most important need to develop digital skills in classes of gifted students	Technical needs	Basic programs in students’ personal computer
		Technical support
		Lab readiness
		Alternative programs
		All-day available platform
		Active internet
	Material needs	Modern computers
		Computers matching the number of students
		Propitious material support
	Development needs	Constant professional development for teachers
	Educational needs	Skills excluded from the curriculum
		Library programs via cloud computing
		Teacher-student sharing
		Scientific research via the Internet
		Positive student attitudes toward digital skills
		Teacher-support tool to promote digital skills
	Enrichment needs	Keeping pace with modern-age requirements in the digital field
		Skills supportive of student’s products and ideas
		Additional applications to meet students’ digital needs

		Digital skills platform that copes with student's level
	Guidance needs	Digital guide
	Moral needs	Student's response to program type
		Teacher's motivation

By analyzing data from teachers' interviews, the following were found needed to develop digital skills in gifted students:

- Technical needs: The teacher, through the interview, mentioned that to develop digital skills, six secondary needs are required. Among them are the following:
 - 1- Basic programs in the student's personal computer. (T2) (Teacher 2) pointed out that some gifted students found that their computers didn't even have the basic programs. (T3 & t 4) also mentioned that some students couldn't download programs to their home computers.
 - 2- Technical support. (T3) noted that teaching digital skills is short of practical sections, creating empirical problems for the teacher.

From what preceded, the researchers realized that the teachers' major needs for digital skills were mainly labs that constantly needed technical support. Results of the current study agree with those of Rayyan (2016), Byqayeh (2016), and Musa & Asadi, (2016), which emphasized the importance of infrastructure with all its constituents, as they help teachers of the gifted in teaching and developing digital skills in students.

From this point, the researchers suggest creating an educational platform specialized in teaching digital skills, containing programs students need and accessible via the internet, to help them solve such problems. In light of modern age requirements, the internet became necessary for schools in compliance with digital directives of the Ministry of Education. Such programs on the internet might be easier to provide than purchasing high-quality computers that occasionally need maintenance and technical support.

- Material needs: The interview revealed that the teachers had a set of materials to be provided to develop digital skills. The needs included four secondary ones, among which were the following:
 - 1- Modern computers: (T2) mentioned that at the end of the year, the user name was deleted and substituted by a new one, so all the files were deleted, making the computer work quicker and easier. (T3) mentioned that school labs should hold high-quality computers with the most updated processors. (T4) pointed out that school computers couldn't handle downloading new programs on them.
 - 2- Computers with the number of students (T2) reported that not all students could obtain computers. The statement was confirmed by what (T4) reported as well.

The material results revealed that digital technology teachers required financial assistance to develop gifted digital skills to enable the gifted student to learn by themselves through their personal computers. A study by (Ozcana &

Bicen, 2016) noted that gifted students see that supportive technology, like platforms, play an important role in teaching them. They also help in exchanging ideas and knowledge. Mawhiba (N.D) emphasized that one positive aspect of digital learning is that it is less costly than equipping classrooms with technology. It added that online learning is not limited to age or time.

- Development needs

Results of the qualitative study revealed that teachers of digital technology needed development necessities to develop digital skills in the gifted, and that involved one secondary need, which is:

- 1- Constant professional development of teachers. (T3) revealed that in a statement, “there were modest attempts in that respect, but in light of modern developed curricula, I didn’t take any training, nor did any of my colleagues”³. (T4) also confirmed that there were things they couldn’t understand and needed training on the internet through colleagues’ experiences on other sites.

Results of interviews disclosed that digital technology teachers need intensive professional courses to ensure pre-qualification and constant development to cope with curriculum needs. Such results agree with those by (Brobis, 2019; Mukalele, 2019; Ghavi et al., 2016), who assured that teachers’ lack of knowledge impedes the development of digital skills in the gifted. Therefore, teachers and gifted students need to use technology as (NAGC, 2019) recommended.

- Education needs:

The semi-structured interview revealed that teachers should have certain education needs to develop students’ digital skills. Those needs involve five sub-ones, among which are the following:

- 1- Skills not embedded in the curriculum, like the inability of students to infuse sounds in videos made by others.

2- Library programs via cloud computing. (T2) reported that students have difficulty with PowerPoint presentations. It would be better if they were taught prezl.

From what was reviewed, it was clear that digital technology teachers perceived the most important educational needs for the gifted, where digital skills were not embedded in the curriculum. They also see that students need to use cloud computing programs that help research, share, and present what they have via the internet. The study agrees with that of (Chen, et al., 2017; Zimlich, 2017), who noted that gifted students seek whoever helps them develop their products by providing them with high-level curricula that cope with the requirements of the modern age. The study also emphasized that teachers need to have participative means to ensure the extent to which the students can perfect their digital skills.

Based on what was given, researchers found it important to have a participative environment based on artificial intelligence (a smart platform for digital skills) that enables teachers to follow up and evaluate students' performance.

The study by (Blair, 2010) found that online learning gives students the freedom to choose what interests them and makes them learn faster than the traditional way. It also helps him to be more open to presenting his ideas and interacting with peers. Mawhiba, (N.D) pointed out that a digital learning environment is one of the convenience measures which make the student feel at ease with his private learning environment (his home). (Choi, et al., 2013) confirm that smart learning is important for the gifted student because it helps develop his skills and breaks time and space barriers.

- Enrichment needs:

Results of the semi-structured interviews revealed that teachers had a set of enrichment needs that they should be provided with to develop students' digital skills; they involve five- sub needs; some of them are:

- 1- A tool to support the teacher in reinforcing digital skills. (T2) stated that she needed to guide students, diversify teaching techniques, exchange activities, and good quality tests.
- 2- Coping with modern-age technology in the digital field. (T2) mentioned that programs matching the technology of the age are to be added, and irrelevant ones are to be deleted.

Teachers' answers reveal that gifted students require enrichment in digital skills, especially skills of design and digital video directing, through applications that help them demonstrate their talents. In addition, they also need multi-level platforms and a follow-up for their progress in this field.

The current study agrees with that of (Zimlich, 2017) in that gifted students benefit more from complicated topics whenever they have a platform with multi-levels of digital skills. Therefore, the researchers see that it is important to include digital skills and digital video directing in the proposed adaptive environment based on artificial intelligence to develop the skills of the gifted.

- Guidance needs:

Teachers also reported that they lacked guidance from which the researchers chose the following secondary ones:

- 1- Digital guide

As elicited from what (T1) said about artificial intelligence and cyber security, researchers realized that students needed advice and guidance on such issues. Hence, a platform run by experts should be created to answer students' queries on such issues.

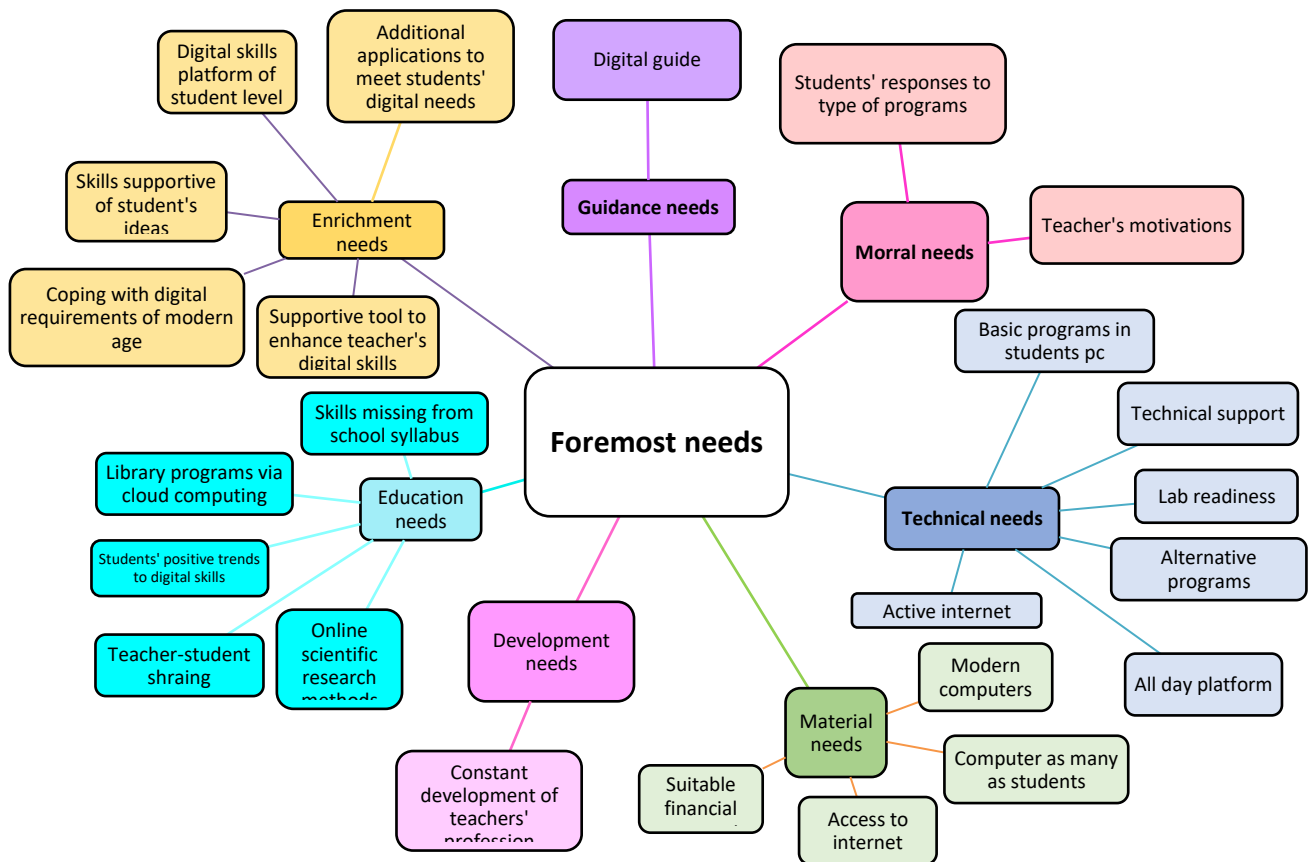
- Moral needs:

Teachers also reported that moral needs were also needed for the gifted. They chose the following two issues:

- 1- From what (T4) Mentioned, the researchers elicited that the students needed programs with which they could interact positively.
- 2- From what (T3 & t4) mentioned, the researchers elicited that teachers needed motivations that should be appreciated. In fact, teaching digital skills is a difficult task for which teachers need to be given letters of thanks to continue doing good jobs.

Results of the current study about this domain agree with the studies by (Choi, 2013 & Blaire, 2010), reiterating that the gifted needed some sort of privacy that was missing from the ordinary syllabus. Therefore, creating a platform might be one of the motives for teachers and students.

The following figure (1) is a visual representation of the foremost necessities that students of digital skills need from the perspective of teachers:



Results and discussions of responses to the third question

The question reads, “what is the perception proposed to design an adaptive environment based on artificial intelligence to develop digital skills in gifted students?

The researchers presented this perception as a result of what the study came up with. The gifted students at the intermediate level need an adaptive environment and smart digital platform to develop their skills by which they can present their products that can be accomplishable in a digital world. Due to all that, the researchers perceived components of the proposed environment as follows:

First: Idea of the proposed perception:

The core of the idea is designing a flexible, integrated, adaptive environment that suits the gifted needs in the digital skills field. It is based on artificial intelligence to gather detailed information about every student to determine the type and level of his learning, which will be developed accordingly. This environment provides them with sources of knowledge that consolidate students’ digital skills. According to this environment, a special file is assigned for each student in which his traits, inclinations, and swift learning are recorded. It also depends on sharing common interests and inclinations among such students.

Second: Philosophy of the proposed perception

The philosophy ascertains that developing digital skills in gifted students is of great significance; it is an ascertained educational approach that won’t be achieved without preparing a flexible, integrated educational environment by which objectives can be achieved through securing learning aids. Therefore, artificial intelligence applications are optimal for enhancing self-learning and widening students’ perceptions to cope with modern-age development.

Third: Significance of the proposed perception

This significance is reflected in the following points:

- 1- It provides an applicable perception that helps raise performance in the educational sector in general.
- 2- It helps achieve a comprehensive, detailed vision with applicable objectives through integration.
- 3- It aims at certain members of society, the gifted students, to enable them to achieve their growing needs through the adaptive environment that encourages learning.

Fourth: Objectives of the proposed perception

These are outlined in the following:

- 1- To enhance interaction between the students themselves, teachers, and the approach in a participative manner.

- 2- To achieve an integrative, adaptive environment that suits the gifted and develops their skills in and outside school.
- 3- To utilize artificial intelligence in learning processes to develop digital skills in the gifted.

Fifth, The proposed perception: Application steps and stages:

- Designing the approach according to the following:
 - 1- Identifying gifted students' traits that cope with age stage.
 - 2- Identifying the required knowledge, skills, and objectives.
 - 3- Identifying the educational content propitious for the objectives.
 - 4- Identifying pillars of the suitable educational environment that involves electronic applications, learning platforms, and a variety of programs supported by artificial intelligence.
- Designing the proposed adaptive environment
This includes the following:
 - 1- Identifying standards of the proposed adaptive environment.

One can benefit from the list of standards for designing an adaptive learning environment based on artificial intelligence listed in the study by Muhammadi (2020). They involve five fields distributed into seventy standards. The fields are:

First: Documenting the adaptive learning environment, controls, morals, credibility, and legality.

Second: Supporting the teaching-learning process in the adaptive-learning environment.

Third: Designing framework of the environment, active technological media, and their processes.

Fourth: producing the sources needed for the adaptive learning environment and its processes.

Fifth: Supporting the adaptive environment by artificial intelligence applications.

- 2- Identifying academic content of the adaptive learning environment.

At this stage, the general objectives of the academic content of the adaptive learning environment, which aims to develop digital skills in gifted students, are identified by utilizing artificial intelligence tools in the learning process. This involves the following general axes of the content:

- Identifying design skills, theoretically and practically, through Infographics. These are used for designing a student's biography or a scientific poster for his ideas.
- Identifying self-marketing skills theoretically and practically by using them to disseminate the gifted students' ideas and products.
- Identifying cloud computing skills via Google, theoretically and practically, by employing them in joint work with others via the internet.

- Identifying online teamworking, theoretically and practically, by using them to serve students, each in the field of his interest.

Figure (2): A proposed explanatory model for presenting contents of the adaptive environment sections.

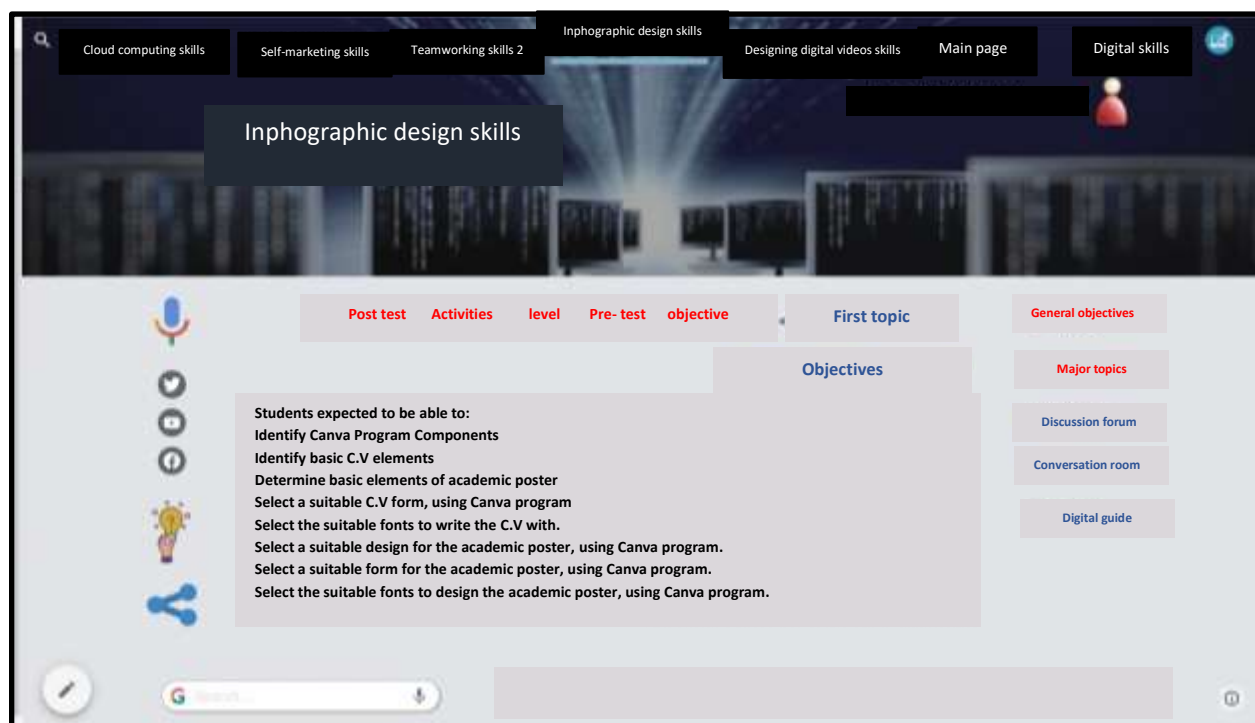


Figure (2) is an example of the section for each specific digital skill; it contains general and special objectives of the skill and pre-and post-tests to measure students' development. Based on the pre-test results, it also specifies the suitable content for the student, added to activities and applications that reinforce learning this skill.

3- Laying out methods of development and application.

The general plan for the adaptive environment is designed at this stage through the following:

- Specifying detailed objectives of the educational content because they are important for creating the educational content for digital skills.
- Designing suitable educational content, taking into consideration the objectives of the educational content, students' traits, and potential.
- Designing educational activities that suit objectives and content considering students' educational levels, abilities, and individual differences.
- Designing active interfaces between learner and adaptive environment using artificial intelligence that belongs to Expert Systems. This system is one of the important domains of artificial intelligence, which mimics human exports in a certain domain that happens through gathering information and

expert experience in one of those domains. (Vladimir Bradac & Bogdan Walet, 2017).

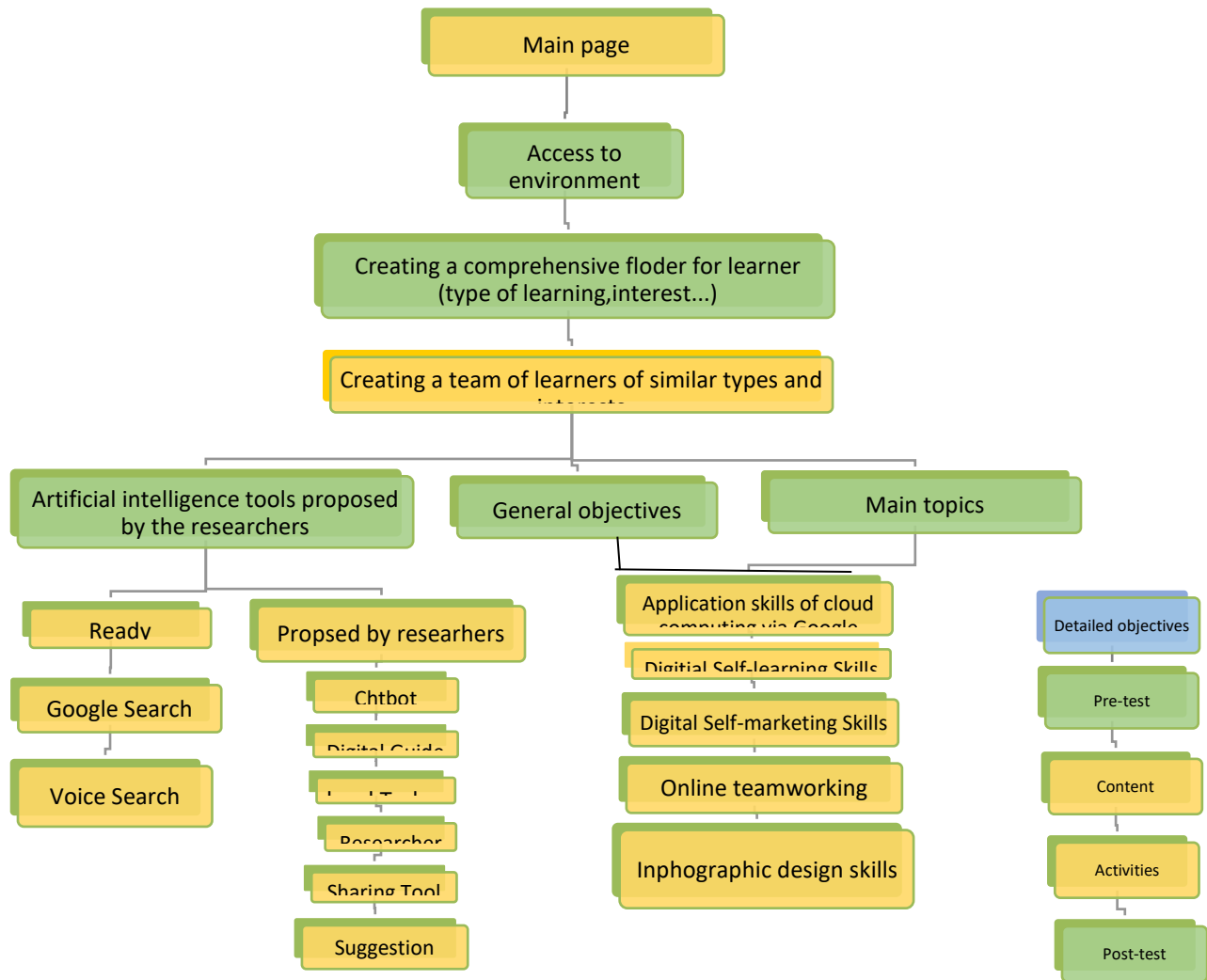
The following table (13) illustrates artificial intelligence applications.

Table (13): Artificial intelligence applications proposed by researchers for the adaptive environment.

No.	Artificial intelligence applications	Function
1-	Chatbot	A tool programmed on artificial intelligence responds to gifted students' queries within 24 hours. It is a supporting tool in the adaptive environment.
2-	Digital Guide	It is a tool that links gifted students to websites and the subjects that attract their attention.
3-	Level Tracker	It is a tool that determines the gifted student's level, follows up on his progress, and sends reports to the student himself and his supervisor, who keeps track of the level of accomplishment and the rate of entry into the environment.
4-	I look for?	It is a tool embedded into the adaptive environment and helps the gifted access more environmental information. It also provides a search ability through voice or written word orders.
5-	Sharing Tool	This tool makes sharing possible between gifted students with the same interests and the same level of skill proficiency. It also provides them with a chance to exchange ideas and experiences.
6-	Suggestion Tool	It is a tool added to all sections to provide opportunities for the gifted students to add their ideas and suggestions about topics in the sections of the adaptive environment.

The environment also contains tools that support it through communication inside or outside the environment, such as social media sites or research tools like digital libraries, as explained in Figure (3).

Figure (3): The student's learning map of digital skills inside the adaptive environment



- Applications: At this stage, coordination with the concerned bodies starts (Directorate of Education, School) to try the adaptive environment. Roles were distributed among gifted students, teaching, and administration bodies to check their effectiveness. Learning implementation followed the specified vocabulary to achieve the adaptive environment via open communication.

Evaluation:

This process passes through four major stages as follows:

- 1- Pre-evaluation: it is carried out by analyzing the current situation.
- 2- Formative evaluation:

The application here is divided into stages whose objectives are specified separately. A follow-up is taken to determine whether or not the objectives for each stage are achieved, so as to intervene at the appropriate time to adjust the course.

3- Post evaluation:

Here, all stages are evaluated after implementation.

4- Feedback:

This step follows post-evaluation as that gives room for modifications and development per results.

Recommendations:

In this part of the study, the researchers would like to recommend the following:

- To benefit from the study's results to design enrichment programs that develop digital skills in the gifted, especially the skills of directing digital videos, and Infographic design, due to their importance in disseminating students' ideas and future projects.
- To create adaptive environments identical to digital skills because such environments induce future learning in fields of their interest and inclinations.
- To apply the proposed perception and to develop it to match students' need for digital skills.
- To conduct further studies on the field of adaptive environment design that is based on artificial intelligence, using the design propitious for academic stage, age group, and teaching material to overcome school lab technical problems. Such environments are easy to access from any computer at any time.
- To use artificial intelligence applications that enhance continuous education in public schools by teaching the syllabus of gifted students to intermediate and secondary levels to upgrade the cognitive and performance levels. These also help teachers develop these levels.

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