Research Article

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Developing Future-Ready Science College Curricula Fostering Competencies for Life and Work

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Abstract

The current study aimed to evaluate the ability of the programs at the Faculty of Science at Prince Sattam bin Abdulaziz University (Biology, Chemistry, and Physics) in developing the competencies necessary for practical life in the 21st century. This was assessed from the perspective of the faculty members and aimed to provide recommendations for the improvement of the curriculum and plans to enhance these competencies. The study adopted an analytical-descriptive approach, which involved analyzing existing frameworks and literature to determine the key principles of competency-based learning and the necessary competencies and skills for life and work in the 21st century. A questionnaire was designed and administered to the faculty members to gauge the availability of these principles and competencies in the curricula of the programs at the Faculty of Science. The results of the study revealed that the competencies of the students in the Faculty of Science were moderate for most competencies and that the curriculum and learning process were not in line with the principles of competency-based learning. This was noted by the faculty members, who stated that their consistency with these principles was moderate. Based on the results of the study, the main recommendation is for the curricula and plans for the programs at the Faculty of Science to be updated to better align with the principles of competency-based learning. This would help to ensure that the graduates are equipped with the necessary competencies and skills to meet the challenges of life and work in the 21st century.

Keywords: *Developing, Future-Ready, Fostering Competencies, Life and Work*

1. Introduction

At the start of the 21st century, curriculum designers and planners faced a big challenge: figuring out what should be taught in schools and universities in light of societies that are changing quickly due to technological advances, changes in population and the environment, and the effects of globalization, which have caused big changes in the job market.The modern curriculum must address these challenges and provide frameworks and models that enable students and graduates to develop the skills and competencies necessary for success in both personal and professional life.

To achieve its primary goal of preparing learners for life and improving society, education's success in helping individuals succeed in the era of rapid knowledge expansion and technological

revolution will depend on their mastery of 21st century competencies. This includes, but is not limited to, strong communication skills, teamwork, leadership, initiative, and the ability to find alternatives and solutions to problems. Furthermore, individuals should be able to evaluate ideas, distinguish between right and wrong based on evidence and logical thinking (Piaget, n.d.).

(Hakkinen, 2017; Weeks, 2019) The curriculum of the 21st century must be a dynamic mix of knowledge, thinking, innovation, skills, information, technology literacy, and real-life experiences. To achieve authentic learning, these elements must be effectively integrated.

2. Literature Review

Higher education institutions have taken on the responsibility of dealing with the problems of the present by giving frameworks and models that help to solve them. To do this, these institutions aim to bridge the gap between the existing skills of students and those expected by the labor market in the near and long term. Higher education institutions must be able to teach their students both cognitive and non-cognitive skills (Gerstein & Friedman, 2016; Kyllonen, 2012) in order to be successful and provide good training and education (Gerstein & Friedman, 2016; Kyllonen, 2012). Enhancing the employability of graduates is also crucial for maximizing available employment opportunities (Ruth & Ramadas, 2019). Twenty-first-century skills have become a key objective for many educational and training institutions and agencies. The needs of the labor market serve as a guide for the development of curricula and the educational process, with the goal of ensuring that students acquire the skills and knowledge necessary to contribute successfully to the workforce and the global economy (National Research Council, 2012). Institutions and agencies have attempted to define these skills by conducting literature reviews, analyzing questionnaire results, consulting with experts and stakeholders, and fostering partnerships between education, business, community, and government leaders. Despite the consensus on the importance of these competencies, defining their components remains a challenge in curriculum development in the twenty-first century due to variations in cultural values and contextual differences among different societies and organizations (Cai & Wong, 2017). Through a review of the literature, it can be concluded that there is a focus on higher cognitive competencies such as problem-solving, critical thinking, decision-making, and innovative thinking, as well as practical life skills such as communication, teamwork, and computer and information literacy.

According to a study by Berkeley (2012), the most important categories of skills can be divided into six groups:

1. Ways of thinking: including creativity and innovation, critical thinking, and problem-solving
2. Decision-making: including learning to learn and metacognition
3. Methods of work include communication and cooperation (teamwork).
4. Tools for action: including ICT literacy
5. Living in the world: including citizenship—local and global
6. Life and work: including personal and social responsibility, cultural awareness, and competence.

Recently, many colleges and universities have been looking into ways to teach 21st-century skills. This involves integrating these skills into a realistic context that supports students in developing and practicing these skills in real-life situations. This approach aligns with the principles of lifelong learning and the shift towards learning societies when designing curricula. (Semilarski & Rannikmäe, 2019; Killowen, 2012).

One of the biggest problems this change movement is facing is figuring out how to teach these skills to students in a way that meets societal expectations. Some people have questioned whether the curricula and models being used are the right ones.(Erstad & Voogt, 2018). Such questions include:

- How can 21st-century skills be effectively integrated into the curriculum?

- What teaching methods are appropriate for these skills?
- What do teachers, administrators, and educational leaders need to do to implement 21st-century skills?
- How can people outside of the formal education system be helped to learn these skills?
- How can technology be used to connect formal and informal educational contexts?
- What types of support do teachers and schools need to help students acquire 21st-century skills?
- How ready are teachers and students to use new ways to test skills for the 21st century?

How effectively questions like why to study, how to connect learning experiences with real-life situations, and what measures to take to accomplish this are addressed impacts the caliber of curriculums. (Mohanasundaram, 2018) This is because different philosophies and models are used to make curriculum. To fix this, there have been a number of efforts to make frameworks for future competency needs, changes to curricula, and research articles that can be used to help make curricula for the 21st century. The concepts used in these frameworks include 21st century skills, future skills, competencies, and lifelong learning (Mohanasundaram, 2018).

Competency-based learning (CBL) has become one of the most important parts of creating curricula that give students the skills and knowledge they need. Kerr et al. (2011) say that the approach focuses on what learners are expected to do instead of what they are expected to know. It also combines the learning and use of knowledge and skills in a professional setting.(Gruppen et al., 2016; Frank & colleagues) say that CBL has a few key features, such as putting the learner at the center and focusing on outcomes and skills.In competency-based curricula, planning starts with defining the learning outcomes, which help decide the curriculum and study plan. Next, the specific competencies that need to be learned are listed (Semilarski & Rannikmae, 2019).This method moves away from teacher-centered practices and toward learner-centered curricula. The length of the program can be changed to meet the unique needs of each learner (Gruppen et al., 2016).

But putting CBL into practice is hard because there are a number of problems, such as figuring out the right skills, measuring skills in the affective domain, not having enough training for teachers, having weak partnerships in the planning and design process, and not having enough institutional flexibility (Vander & Schlusmans, 2007; Ruth & Ramadas, 2019; Likisa, 2018).The success of competency-based curricula also depends on how well they are designed, how well program goals and learning outcomes match up, how they are implemented, and whether or not they contradict each other (Desai & Patil, 2016; Bansl & Dalrymple, 2015).

In the end, using CBL requires that everyone agree on the idea of competencies and that each competency is identified and mastered through a flexible, learner-centered curriculum design. The success of CBL depends on various factors, including the quality of the design and implementation as well as the absence of contradictions (Desai & Patil, 2016; Bansl & Dalrymple, 2015).

3. Statement of the Problem

Many studies criticized higher education institutions for their inability to provide their graduates with the skills they will need in the future in the twenty-first century, and they emphasized the existence of a gap between the outputs of higher education institutions and the competencies of the labor market in many countries and the lack of their graduates' skills to deal with new jobs or practical life in the twenty-first century (Kenayathulla et al. 2019, the study of Al-Awfi (2016), and the study of Salem and Al-Frekh 2018).

This agrees with what the researcher learned about the ruling through her work as a quality consultant regarding the low employment rates in the programs of the Faculty of Science at Prince Sattam bin Abdulaziz University. And the matter may be worse in the near future, as the reports of the Labor Organization and the World Bank indicated that more than two-thirds of jobs in developing countries are subject to automation in the next twenty years (ILO, 2019), which means the

disappearance of many current jobs.

Therefore, many studies and conferences have recommended (Kolomitro, 2017; Rowe & Zegwaard, 2017; International Conference for Education Evaluation 2018, Ahmed 2019, and Lardi 2021) the need to work on building and designing advanced frameworks and curricula that integrate and develop the skills needed by the labor market and economic sectors and highlight the value-added skills in the twenty-first century by adopting initiatives and programs that develop human capital and raise the degree of competitiveness of human resources. Also, it prepares the new generation for future jobs according to the nature of the different disciplines. Competency-based learning was one of the most important entrances to development, as many researchers called for its importance as an entrance to overcome the gap between what is learned within those institutions and the future skills required for life and work.

4. Research Objectives

The current study seeks to achieve the following objectives:

1. From the faculty's point of view, to find out if the college's science courses (Physics, Chemistry, and Biology) are in line with the principles of competency-based learning.
2. demonstrate the capacity of the college science curriculum to develop future competencies necessary for practical life in the twenty-first century.
3. Submitting a proposal to develop curricula for academic programs in colleges of science according to competencies-based learning**.**

5. Methodology

The present study used a descriptive analytic approach to meet its objectives. The literature related to competency-based learning and future skills was reviewed to determine the key principles of competency-based learning. An opinion poll was designed with two main objectives: (1) to assess the alignment of the curricula in physics, chemistry, and biology programs with competency-based learning principles, and (2) to evaluate the programs' ability to develop future competencies required for practical life in the 21st century The methodology can have the following items:

5.1 Study tools

At first, there were 68 questions on the questionnaire, 13 for the first goal and 55 for the second. A group of experts in curriculum and teaching methods made changes to the questionnaire to make sure it was valid, in line with the study's goals, and that the questions were relevant. The final version of the questionnaire had 62 questions. There were 11 questions for the first goal and 51 questions for the second. The questionnaire was distributed to faculty members in the three programs during the first semester of the academic year 2022-2023 using pen and paper, and responses were collected using a five-point Likert scale (1=weak to 5=very high).

5.2 Study Population

The present study approved a total survey, and it targeted all faculty members. All 75 faculty members who hold a PhD in the three programs at the College of Science in Al-Kharj, which include biology, physics, and chemistry, The sample was distributed as follows: 30 members from the Chemistry program, 22 from Biology, and 23 from Physics The data collection was based on the responses from the members who were successfully reached and agreed to participate in the study, as shown in the accompanying tables (1) and (2):

Table 1: Presents the total population, number of participants, and response rate of the study

Table 1: Demographic Information (n = 61)

Section	Total Populations	number of participants	and response rate of the study.
Chemistry	30	25	83%
Biology	22	15	68%
Physics	23	21	91%
the total	75	61	81%

Table 2: "Frequency and Percentage of Responses for Each Variable"

Variable	Answer	Frequency	Percentage
Gender	Male	24	39.3
	Female	37	60.7
Department	Chemistry	25	41.0
	Biology	15	24.6
	Physics	21	34.4
Academic rank	Professor	9	14.8
	Associate Professor	18	29.5
	Assistant Professor	34	55.7
I've been in college since	Two years or less	7	11.5
	from 2 to 5 years	12	19.7
	More than 5 years	42	68.9

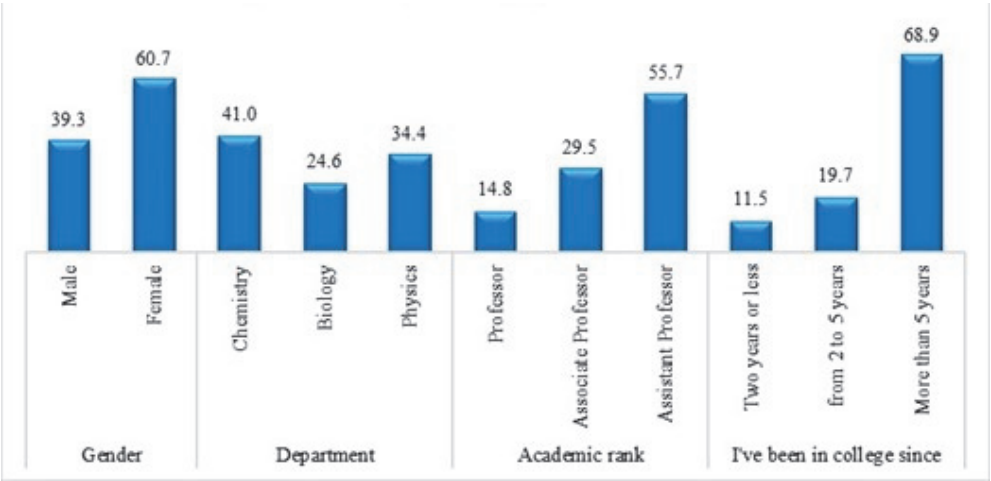

Figure 1: Percentage of demographic Information (n=61)

5.3 *The validity of the questionnaire*

The researcher calculates the Pearson correlation coefficient between each item and the total degree of the domain to which they belong to know the validity of the internal questionnaire as follows in table (3):

Table 3: Pearson Correlation between Statements and Competency-Based Learning Principles

Ilems	Pearson correlation coefficient	P-Value (Sig)	Pearson correlation coefficient	P-Value (Sig)
1	0.658*	0.040	0.851**	0.000
2	0.796*	0.016		
3	0.911**	0.002		
4	0.679*	0.047		
5	0.695*	0.042		
6	0.929**	0.001		
7	0.455*	0.049		
8	0.871**	0.005		
9	0.770*	0.021		
10	0.849**	0.008		
11	0.488*	0.033		
Note: (**) means the correlation statistically significant at (0.01) or less Note: (*) means the correlation statistically significant at (0.05) or less				

Its clear from Table 3, there is a statistically significant relationship between each item and the total degree of domain, and there is a statistically significant relationship between each domain and the total degree of measure.

Table 4: Pearson correlation between statement and competency domain

Domain	Ilems	Pearson correlation coefficient	P-Value (Sig)	Pearson correlation coefficient	P-Value (Sig)
Communication skills	1	0.602*	0.044	0.827*	0.011
	2	0.795*	0.016		
	3	0.849**	0.008		
	4	0.787*	0.018		
	5	0.857**	0.007		
	6	0.516*	0.048		
Cooperative skills	7	0.735*	0.030	0.792*	0.013
	8	0.778*	0.020		
	9	0.533*	0.049		
	10	0.502*	0.049		
	11	0.651*	0.047		
	12	0.893**	0.003		
Problem solving and critical thinking skills	13	0.733*	0.030	0.993**	0.000
	14	0.793*	0.017		
	15	0.961**	0.000		
	16	0.753*	0.025		
	17	0.826*	0.011		
	18	0.977**	0.000		
	19	0.919**	0.002		
	20	0.652*	0.046		
	21	0.689*	0.043		
Creative thinking skills	22	0.816*	0.013	0.735*	0.030
	23	0.949**	0.001		
	24	0.949**	0.001		
	25	0.954**	0.000		
	26	0.854**	0.007		
	27	0.708*	0.037		
Technological literacy	28	0.788*	0.018	0.786*	0.018
	29	0.667*	0.041		
	30	0.866**	0.006		
	31	0.824*	0.011		
	32	0.541*	0.047		
Self-management and learning skills	33	0.720*	0.034	0.907**	0.002
	34	0.653*	0.046		
	35	0.873**	0.005		
	36	0.649*	0.047		
	37	0.837**	0.009		
	38	0.921**	0.002		
	39	0.857**	0.007		
Emotional intelligence skills	40	0.957**	0.000	0.862**	0.006
	41	0.934**	0.001		
	42	0.882**	0.004		
	43	0.937**	0.001		
	44	0.922**	0.002		
Citizenship and environmental preservation skills	45	0.903**	0.003	0.891**	0.004
	46	0.931**	0.001		
	47	0.961**	0.000		
	48	0.986**	0.000		
	49	0.903**	0.003		
	50	0.876**	0.005		
	51	0.761*	0.023		
Note: (**) means the correlation statistically significant at (0.01) or less Note: (*) means the correlation statistically significant at (0.05) or less					

From Table 4: There is a statistically significant relationship between each item and the total degree of domain, and there is a statistically significant relationship between each domain and the total degree of measure. Table 4 shows the Pearson correlation coefficients between each statement and the total degree in domain (develop the necessary competencies):

Table 5: "Correlation between Domain Competencies and Principles of Competency-Based Learning: An Analysis"

Domain	No of item	Pearson correlation coefficient	P-Value (Sig)
Communication skills	6	0.827*	0.011
Cooperative skills	6	0.792*	0.013
Problem solving and critical thinking skills	9	0.993**	0.000
Creative thinking skills	6	0.735*	0.030
Technological literacy	5	0.786*	0.018
Self-management and learning skills	7	0.907**	0.002
Emotional intelligence skills	5	0.862**	0.006
Citizenship and environmental preservation skills	7	0.891**	0.004

From Table 5: There is a statistically significant relationship between each item and the total degree of domain, and there is a statistically significant relationship between each domain and the total degree of measure.

5.4 The Questionnaire's Reliability

A questionnaire's reliability is one of the most important things that determines its validity and usefulness in research. When given to the same people more than once, a reliable questionnaire should always produce the same results. Researchers often use Cronbach's alpha and Pearson correlation coefficients and other tools to make sure that a questionnaire is reliable. These measures help to determine the internal consistency and stability of the questionnaire. The higher the reliability score, the more confidence researchers can have in the results obtained from the questionnaire. From Table 5, we see that the overall reliability coefficient is 0.980, which indicates that the tool is characterized by great stability, which achieves the purposes of the study (Table 6).

Table 6: Reliability coefficients (Cornbrash's alpha)

Domain	Sub-domain	Items	Coefficients Cronbach's alpha
Principles of competency-based learning	Overall (competency-based learning principles)	11	0.932
Develop the competencies necessary	Communication skills	6	0.847
	Cooperative skills	6	0.873
	Problem solving and critical thinking skills	9	0.922
	Creative thinking skills	6	0.955
	Technological literacy	5	0.788
	Self-management and learning skills	7	0.912
	Emotional intelligence skills	5	0.900
	Citizenship and environmental preservation skills	7	0.917
	Overall (Develop the competencies necessary)	51	0.977
Overall reliability coefficients		62	0.980

The five-point Likert scale is used to evaluate the estimates of the arithmetic mean and its

explanatory significance. According to this scale, the following criteria have been established:

1. A value from 1 to less than 2.3 is considered too low.
2. A value less than 2.3 to less than 3 is considered low.
3. A value from 3 to less than 3.7 is considered medium.
4. A value from 3.7 to less than 4.4 is considered high.
5. A value of 4.4 is considered very high.

The theoretical mean for this scale is 3, and the value of the increase or decrease is used to determine the level of significance.

5.5 *Statistical methods*

In this study, descriptive statistics, such as frequency, percentages, mean, standard deviation, and figures, were used to look at the data and help people understand the results better. To measure the validity and internal consistency of the data, Pearson correlation coefficients were used. The reliability of the data was determined using Cronbach's alpha coefficients. Independent sample (t) tests were performed to determine if there were any significant differences in the means of the responses based on gender. To determine the significance of differences in the means of the responses based on department, academic rank, and number of years in college, a one-way ANOVA was used. The data analysis was performed using the Statistical Package for Social Sciences (SPSS), version 25.

6. Results

Table 7: Descriptive statistics for each item in the domain (principles of competency-based learning)

No	Item	Very high	High	Medium	Low	Very low	Mean	Standard deviation	Ranking	Interpretation
2	Designed with the aim of providing the student with skills for practical life	9 14.8%	31 50.8%	17 27.9%	4 6.6%	0 0.0%	3.74	0.79	1	High
9	provides resources and equipment that help students acquire practical life skills.	9 4.9%	20 32.8%	29 47.5%	9 14.8%	0 0.0%	3.72	0.78	2	High
7	Apply appropriate teaching strategies to develop students' practical life skills.	11 18%	27 44.3%	18 29.5%	4 6.6%	1 1.6%	3.70	0.90	3	Medium
4	It includes training students in practical skills and the tasks they need when transitioning to working life.	5 8.2%	35 57.4%	16 26.2%	5 8.2%	0 0.0%	3.66	0.75	4	Medium
1	ensures a clear identification of competencies and skills for future work.	9 14.8%	31 45.9%	17 29.5%	4 9.8%	0 0.0%	3.66	0.85	5	Medium
3	Built in the light of what professional bodies have defined as the characteristics of future graduates	8 13.1%	32 52.5%	12 19.7%	9 14.8%	0 0.0%	3.64	0.90	6	Medium
10	It aims to raise students' levels top performance.	11 18.0%	24 39.3%	16 26.2%	8 13.1%	2 3.3%	3.56	1.04	7	Medium
11	It helps students to adapt the changing demands and circumstances brought by the great cognitive and technical development	3 4.9%	28 45.9%	22 36.1%	8 13.1%	0 0.0%	3.43	0.78	8	Medium
8	Continuously reviewed to update skills according to the needs of the labor market	9 14.8%	21 34.4%	18 29.5%	11 18.0%	2 3.3%	3.39	1.05	9	Medium
6	It provides a realistic context for applying future skills in practical life.	6 9.8%	23 37.7%	21 34.4%	10 16.4%	1 1.6%	3.38	0.93	10	Medium
5	promotes the practice of appropriate extracurricular activities to develop practical life skills.	4 6.6%	27 44.3%	16 26.2%	14 23.0%	0 0.0%	3.34	0.91	11	Medium
	Overall mean						**3.57**	**0.68**	-	Medium

According to the results of the study, the overall mean score for the first axis of competency-based learning was 3.57 (SD = 0.68). This average indicates that the sample group demonstrated moderate approval of this axis. The aim of this educational approach is to equip students with practical life skills by providing resources and equipment that facilitate the acquisition of these skills. The mean scores for the second and third aspects of this approach were 3.74 (SD = 0.79) and 3.72 (SD = 0.78), respectively.

The educational approach also emphasizes the importance of the practical application of skills

in real-life contexts and encourages participation in extracurricular activities that promote the development of practical life skills. The mean scores for these two aspects were 3.38 (SD = 0.93) and 3.34 (SD = 0.91), respectively.

Table 8: Descriptive statistics for each domain in (Develop the competencies necessary)

No	Domain	Mean	Standard deviation	Ranking	Interpretation
4	Creative thinking skills	3.16	0.94	8	Medium
6	Self-management and learning skills	3.44	0.69	7	Medium
3	Problem solving and critical thinking skills	3.48	0.62	6	Medium
8	Citizenship and environmental preservation skills	3.55	0.66	5	Medium
2	Cooperative skills	3.55	0.59	4	Medium
5	Technological literacy	3.64	0.59	3	Medium
1	Communication skills	3.67	0.58	2	Medium
7	Emotional intelligence skills	3.68	0.67	1	Medium
	Overall mean	3.51	0.57	-	Medium

From table (8) Illustrated:

With a standard deviation of 1.23, the average score across all domains related to developing necessary competencies was found to be 3.57. This indicates that the sample's approval of the competencies in question was of a medium degree. Among the sub-domains, communication skills had the highest mean score of 3.67 with a standard deviation of 0.58. Citizenship and environmental preservation skills had the lowest mean score of 3.55, with a standard deviation of 0.66.

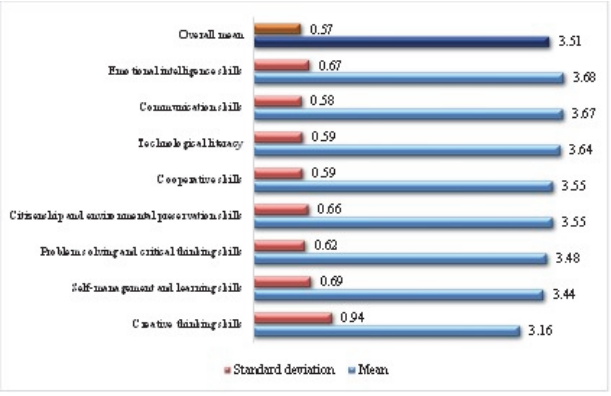

Figure 2: Descriptive statistics for each sub-domain in (Develop the competencies necessary)

Table 9: Descriptive statistics for each item in the domain (develop the competencies necessary)

Sub-domain	No	Item	Very high	High	Medium	Low	Very low	Mean	Standard deviation	Ranking	Interpretation
communication skills	2	Display information clearly and consistently.	16 26.2%	30 49.2%	15 24.6%	0 0.0%	0 0.0%	4.02	0.72	1	High
	3	Speak briefly and clearly.	9 14.8%	30 49.2%	21 34.4%	1 1.6%	0 0.0%	3.77	0.72	2	High
	1	Express their ideas using different means	8 13.1%	32 52.5%	19 31.1%	2 3.3%	0 0.0%	3.75	0.72	3	High
	5	Use of social media and multiple technologies to communicate and produce models	9 14.8%	27 44.3%	21 34.4%	4 6.6%	0 0.0%	3.67	0.81	4	Medium
	6	communicate effectively in a variety of environments (including different languages)	5 8.2%	24 39.3%	26 42.6%	6 9.8%	0 0.0%	3.46	0.79	5	Medium
	4	Writing different types of texts and reports for different purposes.	6 9.8%	19 31.1%	27 44.3%	9 14.8%	0 0.0%	3.36	0.86	6	Medium
		Overall average.						3.67	0.58	-	Medium

Sub-domain	No	Item	Very high	High	Medium	Low	Very low	Mean	Standard deviation	Ranking	Interpretation
Cooperative skills	7	Effective cooperation with different working teams.	7 11.5%	31 50.8%	21 34.4%	2 3.3%	0 0.0%	3.70	0.72	1	High
	10	Share responsibility with work teams to achieve results.	6 9.8%	32 52.5%	21 34.4%	2 3.3%	0 0.0%	3.69	0.70	2	Medium
	9	Planning with the work team to achieve the goals according to a specific timetable	6 9.8%	28 45.9%	22 36.1%	4 6.6%	1 1.6%	3.56	0.83	3	Medium
	8	Active participation in problem solving that are facing the teams work.	4 6.6%	28 45.9%	25 41.0%	3 4.9%	1 1.6%	3.51	0.77	4	Medium
	11	Propose constructive solutions to overcome the challenges facing the work team.	4 6.6%	28 45.9%	22 36.1%	7 11.5%	0 0.0%	3.48	0.79	5	Medium
	12	Contribute to improving the performance of the team's work in light of the feedback.	5 8.2%	18 29.5%	33 54.1%	5 8.2%	0 0.0%	3.38	0.76	6	Medium
		Overall average.						3.55	0.59	-	Medium
Problem solving and critical thinking skills	21	Gather relevant information from reliable sources.	7 11.5%	32 52.5%	21 34.4%	1 1.6%	0 0.0%	3.74	0.68	1	High
	20	Analyze and extract relationships between different information.	7 11.5%	35 57.4%	14 23%	5 8.2%	0 0.0%	3.72	0.78	2	High
	13	Use previous knowledge to solve problems.	6 9.8%	33 54.1%	19 31.1%	3 4.9%	0 0.0%	3.69	0.72	3	Medium
	14	Determine the domains of the problem they are facing.	5 8.2%	25 41%	26 42.6%	5 8.2%	0 0.0%	3.49	0.77	4	Medium
	16	Choosing appropriate problem-solving strategies.	5 8.2%	27 44.3%	22 36.1%	7 11.5%	0 0.0%	3.49	0.81	5	Medium
	17	Evaluate different ideas in light of logical criteria	4 6.6%	26 42.6%	19 31.1%	12 19.7%	0 0.0%	3.36	0.88	6	Medium
	15	Distinguish between opinions and facts.	1 1.6%	30 49.2%	16 26.2%	14 23%	0 0.0%	3.30	0.84	7	Medium
	19	Employ higher-order thinking skills to solve the problem.	3 4.9%	24 39.3%	22 36.1%	12 19.7%	0 0.0%	3.30	0.84	7	Medium
	18	Develop appropriate solutions or alternatives to solve problems.	3 4.9%	22 36.1%	24 39.3%	12 19.7%	0 0.0%	3.26	0.83	9	Medium
		Overall average						3.48	0.62	-	Medium
Creative thinking skills	27	Reuse popular materials or ideas in smart new ways.	7 11.5%	18 29.5%	21 34.4%	14 23.0%	1 1.6%	3.26	1.00	1	Medium
	25	Combine different things to produce something new that is different.	7 11.5%	21 34.4%	13 21.3%	17 27.9%	3 4.9%	3.20	1.12	2	Medium
	22	Employ creative thinking skills to produce new ideas.	2 3.3%	24 39.3%	18 29.5%	15 24.6%	2 3.3%	3.15	0.95	3	Medium
	24	Use brainstorming to develop ideas.	5 8.2%	20 32.8%	17 27.9%	17 27.9%	2 3.3%	3.15	1.03	4	Medium
	26	Creating new and unique ideas	4 6.6%	23 37.7%	15 24.6%	16 26.2%	3 4.9%	3.15	1.05	5	Medium
	23	Creative problem solving	3 4.9%	21 34.4%	18 29.5%	14 23%	5 8.2%	3.05	1.06	6	Medium
		Overall average.						3.16	0.94	-	Medium
Technological literacy	31	Use social media to communicate effectively with others	8 13.1%	33 54.1%	17 27.9%	3 4.9%	0 0.0%	3.75	0.75	1	High
	30	Employing information and communication technology in teaching and learning processes	8 13.1%	34 55.7%	15 24.6%	4 6.6%	0 0.0%	3.75	0.77	2	High
	28	Searching for information in various technological sources	6 9.8%	35 57.4%	15 24.6%	4 6.6%	1 1.6%	3.67	0.81	3	Medium
	32	Analyzing information available on social media and verifying its credibility	6 9.8%	28 45.9%	19 31.1%	7 11.5%	1 1.6%	3.51	0.89	4	Medium
	29	Adequate knowledge and understanding of the ethical/legal issues surrounding the use of information technology	4 6.6%	28 45.9%	24 39.3%	4 6.6%	1 1.6%	3.49	0.79	5	Medium
		Overall average.						3.64	0.59	-	Medium
Self-management and learning skills	33	Determine your educational goals	10 16.4%	23 37.7%	26 42.6%	2 3.3%	0 0.0%	3.67	0.79	1	Medium
	39	Decision making and taking responsibility	7 11.5%	29 47.5%	19 31.1%	6 9.8%	0 0.0%	3.61	0.82	2	Medium
	37	Choose the appropriate learning method	7 11.5%	23 37.7%	24 39.3%	7 11.5%	0 0.0%	3.49	0.85	3	Medium
	34	Planning for the learning process	7 11.5%	21 34.4%	26 42.6%	7 11.5%	0 0.0%	3.46	0.85	4	Medium
	38	Managing time to achieve goals effectively	7 11.5%	22 36.1%	24 39.3%	8 13.1%	0 0.0%	3.46	0.87	5	Medium
	36	quickly adapt to changes	5 8.2%	19 31.1%	26 42.6%	11 18%	0 0.0%	3.30	0.86	6	Medium
	35	practising self-reflection and identifying strengths and weaknesses in her or his performance.	4 6.6%	18 29.5%	20 32.8%	19 31.1%	0 0.0%	3.11	0.93	7	Medium
		Overall average.						3.44	0.69	-	Medium
Emotional intelligence skills	44	commitment to morals and societal values	11 18%	33 54.1%	13 21.3%	4 6.6%	0 0.0%	3.84	0.80	1	High
	42	Build good relationships with peers.	5 8.2%	37 60.7%	15 24.6%	4 6.6%	0 0.0%	3.70	0.72	2	High
	40	Respect other people's points of view.	9 14.8%	31 50.8%	14 23.0%	7 11.5%	0 0.0%	3.69	0.87	3	Medium

Sub-domain	No	Item	Very high	High	Medium	Low	Very low	Mean	Standard deviation	Ranking	Interpretation
	41	Control her/his emotions and don't overreact.	7 11.5%	32 52.5%	17 27.9%	5 8.2%	0 0.0%	3.67	0.79	4	Medium
	43	Dealing with stress in a constructive manner	4 6.6%	29 47.5%	22 36.1%	6 9.8%	0 0.0%	3.51	0.77	5	Medium
		Overall average.						3.68	0.67	-	Medium
Citizenship and environmental preservation skills	50	commitment to social rights and responsibilities	8 13.1%	27 44.3%	22 36.1%	4 6.6%	0 0.0%	3.64	0.80	1	Medium
	49	Rational use of water	6 9.8%	29 47.5%	22 36.1%	3 4.9%	1 1.6%	3.59	0.80	2	Medium
	48	Efficient use of energy	8 13.1%	27 44.3%	19 31.1%	7 11.5%	0 0.0%	3.59	0.86	3	Medium
	47	Using different resources in ways that preserve the environment.	6 9.8%	28 45.9%	22 36.1%	5 8.2%	0 0.0%	3.57	0.78	4	Medium
	45	Initiative to solve societal problems.	5 8.2%	27 44.3%	26 42.6%	3 4.9%	0 0.0%	3.56	0.72	5	Medium
	51	Employ different thinking skills to deal with national and international issues	5 8.2%	28 45.9%	19 31.1%	9 14.8%	0 0.0%	3.48	0.85	6	Medium
	46	Understand the impact of globalization and global changes on the country and life and how to deal with them.	6 9.8%	21 34.4%	28 45.9%	6 9.8%	0 0.0%	3.44	0.81	7	Medium
		Overall average.						3.55	0.66	-	Medium

Table 10: Results of One Way ANOVA to the significance differences between the mean of the responses of study sample (Principles of competency-based learning, Develop the competencies necessary) according to (Department).

Domain	Sub-domain	Category	N	Mean	Std. Deviation	F	P-Value
Principles of competency-based learning	Overall (Principles of competency-based learning)	Chemistry	25	3.48	0.59	16.94**	0.00
		Biology	15	3.00	0.66		
		Physics	21	4.07	0.41		
Develop the competencies necessary.	Communication skills	Chemistry	25	3.62	0.56	7.55**	0.00
		Biology	15	3.31	0.55		
		Physics	21	3.99	0.47		
	Cooperative skills	Chemistry	25	3.51	0.64	6.05**	0.00
		Biology	15	3.21	0.35		
		Physics	21	3.85	0.55		
	Problem solving and critical thinking skills	Chemistry	25	3.52	0.49	15.39**	0.00
		Biology	15	2.90	0.47		
		Physics	21	3.86	0.57		
	Creative thinking skills	Chemistry	25	3.16	0.96	16.99**	0.00
		Biology	15	2.29	0.46		
		Physics	21	3.78	0.63		
	Technological literacy	Chemistry	25	3.59	0.59	6.19**	0.00
		Biology	15	3.29	0.55		
		Physics	21	3.93	0.47		
	Self-management and learning skills	Chemistry	25	3.43	0.60	10.69**	0.00
		Biology	15	2.90	0.44		
		Physics	21	3.84	0.70		
	Emotional intelligence skills	Chemistry	25	3.61	0.55	6.08**	0.00
		Biology	15	3.32	0.65		
		Physics	21	4.03	0.66		
	Citizenship and environmental preservation skills	Chemistry	25	3.62	0.61	4.42*	0.02
		Biology	15	3.15	0.60		
		Physics	21	3.76	0.65		
	Overall (Develop the competencies necessary)	Chemistry	25	3.50	0.51	13.94**	0.00
		Biology	15	3.03	0.38		
		Physics	21	3.87	0.49		

From Table 10: The results of the study sample's responses regarding the principles of competency-based learning and the development of necessary competencies showed statistically significant differences among departments at a significance level of 0.05 or less. These differences were found to be in favor of the physics department across all sub-domains and overall domains.

7. Discussion

The results presented in Tables 9 and 10 suggest that faculty members view the ability of science

programs at the Faculty of Science to develop future skills for life and work in the 21st century as medium and their level of satisfaction with the outcomes as not high. This aligns with the findings of studies such as those by Nieveen and Plomp (2018), who found that there is still a gap between the skills and competencies that graduates possess and those that they need for future life and work. The authors argue that designing and implementing a curriculum that integrates 21st-century skills is a complex process that requires significant changes to the curriculum's design and learning procedures. The results of this study show that the curriculums and ways of learning in the Faculty of Science programs were not well aligned with the principles of competency-based learning.According to faculty members, the level of consistency with these principles was moderate. Although they agreed that the programs were designed to provide students with the necessary competencies and skills for future life, many of the key elements of quality competency-based learning were not in place. The faculty members' average level of satisfaction with the competency-based curriculum suggests that many of the essential practices for planning and implementing this approach were not met to a satisfactory degree.

This fits with what Ruth and Ramadas (2019) found. They say that programs need to be well-equipped and ready to use competency-based learning.The authors also suggest that the teaching process, evaluation, and curriculum design must be flexible and realistic and must support students' acquisition of tasks and competencies, as well as stimulate their self-motivation. In addition, the authors argue that faculty members, leaders, and the institutional community must be well prepared to implement competency-based learning.

The goal of this study is to give clear directions and frameworks for creating competency-based curricula by defining the steps and roles of different stakeholders, such as faculty members, students, planning committees, and institutional leaders.This fits with the second goal of the study, which is to give a clear picture of how competency-based curricula can be made.

The results shown in Tables 9 and 10 show that the faculty members of the Faculty of Science think their programs do a moderate job of teaching 21st-century skills and competencies for life and work, and that they are not very happy with these skills and competencies. Communication, cooperation, problem-solving and critical thinking, creative thinking, technological literacy, self-management and learning, emotional intelligence, and citizenship and protecting the environment are some of the skills and competencies that are evaluated. These findings are in line with the conclusions of Nieveen and Plomp (2018), who found that a gap remains between the skills and competencies that graduates possess and what they need to succeed in the future and that designing and implementing a curriculum that integrates these skills is a challenging task that requires significant changes in the design and delivery of curriculum and learning activities.

Based on what the faculty members said in this study, it seems that the programs in the Faculty of Science do not follow the principles of competency-based learning very well.The teachers think that the curriculum was meant to give students the skills and knowledge they needed, but they also think that many of the most important conditions and features for high-quality competency-based learning were not met.This is supported by the results of the second question in the table, which show that the degree of satisfaction with the study community was average for many of the practices that are considered fundamental to competency-based learning, as identified in phrases 11, 10, 1, 3, 4, 5, 6, 7, 8, and 9 in Table 7.

The results are also in line with the work of Ruth and Ramadas (2019), who said that the difference between expectations and actual results is partly due to the fact that competency-based learning programs don't have enough preparation and support.Effective implementation requires teaching and assessment activities that are flexible and realistic, help students learn skills and competencies, encourage them to be self-motivated, and give teachers the training and support they need.Strong institutional leadership is also needed to support the development project and get students and faculty members to accept change.

To close the gap between what was expected and what actually happened, it is suggested that the curriculum be set up so that it covers all of the necessary skills and integrates them into the right

subject areas, that evaluation processes be set up to help students learn and make the curriculum better, and that the structure of the program be made to fit each student's path of developing skills. The principle of participatory curriculum should be used. Students, faculty, graduates, and employers should all be involved in the development process, and effective ways should be found to close the gap between planning and implementation. The selection of planning committees in different disciplines should be based on criteria that ensure the presence of integrated and comprehensive visions for the design process and include educational experts familiar with competency-based curriculum design as well as academic specialists in relevant subject areas. Finally, there are a few categories that can play a good role in educational development, as follows:

7.1 The Role of Leaders in Educational Development

Leadership plays a crucial role in promoting the success of an educational development project. Leaders must work to foster a shared understanding of the goals and benefits of the project and address any fears or misunderstandings that may lead to resistance among students, faculty, and other stakeholders. To achieve this, leaders should aim to clarify the goals and importance of the project, emphasizing that it aligns with personal interests and does not conflict with them.

Leaders can also encourage curricula that involve everyone by including students, faculty, graduates, and employers in the process of making them .Leaders can make sure that the curriculum design is thorough and well-planned by putting together planning committees with experts in competency-based curriculum design and academic experts in subjects like physics, chemistry, and biology.

Leaders must also give faculty members the tools and support they need to learn the skills and abilities they need to use a competency-based learning approach. This includes tools for assessment, teaching, and learning strategies.

7.2 The Role of Development Committees in Educational Development

Frank (2010) says that the committees in charge of making programs and curricula should make sure that they are in line with the principles of competency-based learning .The first step in the development process is coming up with a development philosophy, making plans to spread the culture of competency-based learning, figuring out its most important principles and requirements, and figuring out what faculty members and students' roles are in this method. It is crucial to obtain the support of stakeholders and to ensure faculty members understand the importance of this change and development before the curriculum design process can begin. Next, the main issues and trends in each specialization and learning method are identified, and the educational needs are evaluated. This information is used to determine the capabilities and characteristics required of graduates for specific jobs and tasks and to align with the requirements of the labor market. Information is collected through observation and task analysis of reliable professional activities, as well as through interviews and opinion polls with professionals or recent graduates, to identify the needs and interests of learners. The collected information is then translated into skills and competencies in the form of learning outcomes. These competencies serve as the main guide for all teaching and learning processes, including curriculum design, implementation, and evaluation. To ensure mastery, the curriculum design should include appropriate study plans to cover all required competencies and consider the idea of back-design to determine the educational experiences and activities necessary for learners to fully address each competency.

The production of curricular documents is crucial for putting the planned curriculum into action. These documents should exhibit the consistency of curricular components and arrangements, with a focus on three areas: 1) vertical alignment of the curriculum by defining educational outcomes and necessary experiences and activities for achievement (e.g., course titles and descriptions), ensuring a logical progression of learning skills and competencies, 2) horizontal consistency of the

curriculum by defining specific learning outcomes, assessment plans and methods, appropriate teaching and learning activities, and scientific content for each course to achieve intended skills and competencies; and 3) implementation processes, which need to be closely monitored to ensure consistency with the documented curriculum and to take advantage of evaluation results in guiding learning processes and tracking student progress. The design and implementation of a competency-based curriculum are important for its success (Frank, 2010).

7.3 The Role of Teaching staff members in Educational Development

The teaching staff is a key part of the success of educational innovation because it is their job to make plans happen. To be successful, they should be involved in the process of making the curriculum, understand its principles and philosophies, and deal with any problems that come up during implementation. They should also take advantage of opportunities for self-development and professional development to get the skills and knowledge they need to use new ways of teaching and assessing students well. Also, they should be involved in spreading the word about the development culture and the requirements for implementation among students, professionals, and other relevant stakeholders. It is also important to work together to come up with ways to get students more interested in learning and to deal with things that might make them not want to change. The staff should also think about how they teach, collect data, and do research to come up with ideas for how to make things better. In their new role as facilitators of the learning process, they should give students advice, help them choose the right courses, and help them learn the skills and knowledge they need for real life. Lastly, they should figure out what each student needs and give them opportunities to do well.

7.4 The Role of Students in Educational Development

Students can also be more motivated and interested in learning if they are involved in planning the curriculum .When students have a say in what they are learning, they are more likely to feel invested in the outcome. This can result in better academic performance and a greater sense of fulfillment. Furthermore, incorporating student feedback into the curriculum can help identify areas that need improvement and lead to a more effective and relevant learning experience. This can help address the challenges students face during the implementation process and improve the overall quality of education.

Overall, including students in the process of planning the curriculum is good for both the students and the school .It makes learning more personalized and relevant, boosts motivation and engagement, and helps teachers understand the needs and points of view of the whole student body. Recommendations for institutions looking to improve their curricula and ensure the acquisition of twenty-first-century competencies by their students.

As is clear from the following figure, which shows the proposed vision for developing the educational process according to competency-based science and according to the different roles of each category.

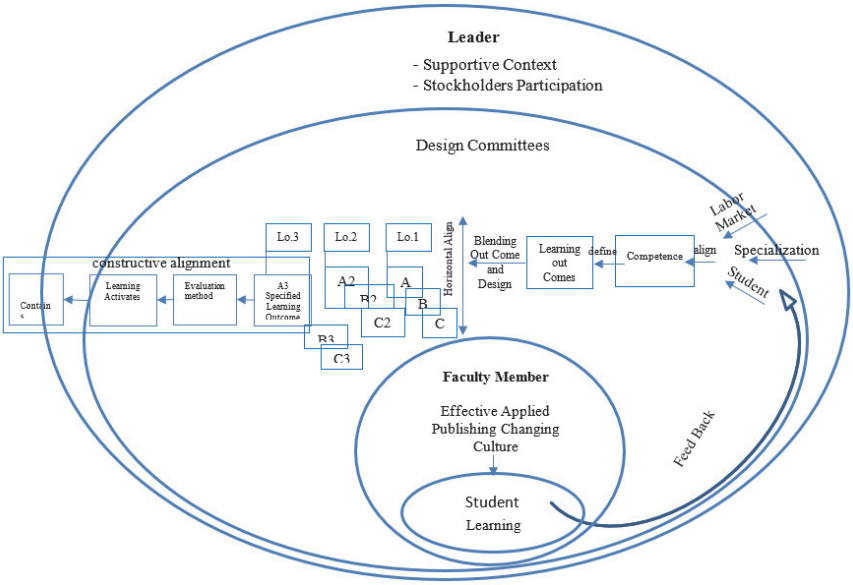

Figure 1: The proposed vision for developing the educational process based on Competency - based learning and the distinct roles of each category is evident in the following graph. (A suggested proposal from the author's point of view.)

8. Conclusion

This study shows that there is a big difference between the skills and knowledge that students actually have and the skills and knowledge that are needed for real life in the 21st century .It shows how important it is for schools to align their curriculums with the principles of competency-based learning to make sure that their graduates have the right skills and knowledge .This study adds to what has already been written by giving a full evaluation of the programs at the Faculty of Science at Prince Sattam bin Abdulaziz University. This evaluation includes an analysis of existing frameworks and literature, a questionnaire to see how many competencies and skills are taught in the programs, and a summary of the results and recommendations. The study also shows how important leadership and development committees are for putting competency-based learning into practice and how important it is to give faculty members the skills they need to do their jobs well .This study provides practical and actionable

9. Recommendations

1. More research can be done to find out what kinds of specialized vocational skills students in each program at the Faculty of Science need. This can be done by bringing together academic researchers and professionals from the business world to make sure the results are relevant and useful.
2. To deal with the problems that come with putting competency-based learning into place, a task force made up of people from higher education institutions, faculty members, and other important people can be set up to find the problems and come up with solutions. This can also include holding regular meetings and workshops to share resources and talk about the best ways to do things.
3. Experts in curriculum development and assessment, such as instructional designers and

assessment experts, can help make clear and concise guides for building curricula based on the principles of competency-based learning. As a way to help institutions adopt the competency-based approach, these guides can be made widely available through online resources and workshops.

10. Study Implications

The research on the programs at the Faculty of Science at Prince Sattam bin Abdulaziz University and their ability to teach 21st-century skills has the following results:

1. Competency-based learning needs to be part of the curriculum and learning process so that graduates have the skills and knowledge they need for life and work in the 21st century.
2. The difference between what students can actually do and what they need to do in real life shows how important it is for schools to focus on developing these skills.
3. The fact that the design, implementation, and evaluation of the programs don't always match up with the principles of competency-based learning shows that clear and detailed frameworks are needed to make sure that all stakeholders are integrated well.
4. Leadership and development committees' job is to help with and keep an eye on the implementation of these frameworks, making sure that planning and implementation are done in the same way every time.
5. How important it is to give faculty members the skills they need to create and use competency-based teaching and grading practices
6. Because of these effects, education institutions need to put 21st-century skills at the top of their list of priorities and make sure that their planning, implementation, and evaluation processes are consistent.

11. Study Limitations

The study presents several opportunities for improvement. Increasing the sample size would allow for more statistically significant conclusions. Conducting a longitudinal study would capture any long-term effects, leading to a more comprehensive understanding of the topic. Incorporating additional methods, such as observation and feedback from multiple sources, would provide a more objective and comprehensive evaluation of the data. Finally, taking cultural differences into account would provide a more nuanced understanding of the results, thereby increasing the study's impact and applicability.

These points provide valuable opportunities for improving future studies. We can better prepare for research that yields statistically significant conclusions. We can conduct studies over longer periods of time, accounting for both short-term and long-term effects. Additionally, we can use a variety of data collection methods, such as observation and feedback from multiple sources, to ensure that our findings are objective and comprehensive. By taking cultural differences into account, we can also better understand the impact of these factors on our results. With these opportunities for improvement in mind, we can conduct more effective and impactful studies in the future.

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