Analysis of the Content of the Physics Textbook of the 3rd Intermediate Grade According to the Criteria for Designing and Producing in Fographics

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تحليل محتوى كتاب الفيزياء للصف الثالث المتوسط وفق معايير تصميم وانتاج الانفوجرافيك

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Abstract

In this study, the researcher aims to analyze the content of the physics textbook for the 3rd intermediate grade according to the criteria for designing and producing infographics, and the research community consists of the content of the physics textbook for the 3rd intermediate grade intermediate grade for the academic year 2021-2022. The researcher adopted the analysis instruments with a number of the criteria for designing and producing infographics. The results revealed randomness in the percentage of the criteria included in the content of the physics textbook for the 3rd intermediate grade, and they are not compatible with the proposed criteria by the experts also. **Keywords**: Infographics, Criteria, Analysis, Textbook, Physics

المستخلص

يهدف الباحث في هذه الدراسة الى تحليل محتوى كتاب الفيزياء للصف الثالث المتوسط وفقا لمعايير تصميم وانتاج الانفوجرافيك وتكون مجتمع البحث من محتوى كتاب الفيزياء للصف الثالث المتوسط للعام الدراسي ٢٠٢١ – ٢٠٢٢ ، وتمثلت العينة بالاشكال والمخططات والرسوم في محتوى الكتاب. اعتمد الباحث اداة التحليل بعدد من المعايير لتصميم وانتاج الانفوجرافيك، وتمخضت النتائج عن العشوائية في نسب المعايير المتضمنة في محتوى كتاب الفيزياء للصف الثالث المتوسط ، كما انها غير متوافقة مع المعايير المقترحة من قبل الخبراء.

الكلمات المفتاحية: الانفوجرافيك ، المعايير ، التحليل ، الكتاب مدرسي ، الفيزياء

Problem Statement

Based on the researcher's experience in the field of studying and teaching physics, in addition to exchanging opinions with some teachers of the subject and parents, as well as reviewing the results of some studies and opinion polls globally and in the Arab world, it became clear that the poor achievement of students and their weak desire to study physics may be due to the nature of the content of the textbook. What it contains of dry, complex and monotonous materials does not encourage students to continue studying and understand it, which leads to exclusion and alienation of students from it. For the success of any educational process in achieving its objectives, the curriculum, which is the basis of the educational process, must be subjected to continuous evaluation and review that includes all its elements and its planning and implementation processes, which are considered the textbook which is the most important instrument adopted by the curriculum in achieving the set objectives. Despite the multiplicity of educational activities and educational materials and the tremendous development in educational technology and the introduction of modern teaching aids, the textbook still occupies a great importance in the teaching and learning processes. One of the most important trends that resulted from the interaction of all the previous fields is the direction towards what is called the mental image. There is no dispute about the importance of the image in the educational process and its prominent role in facilitating and communicating information and the survival of its impact for a longer time because of the different senses of the learner that address it, and stimulate the stimulus for him to respond. From this standpoint, educational shapes, drawings, pictures, and others appeared (Alsoub, 2021). It is noted today that many newspapers, blogs, and social media use many pictorial data that are now called the term infographics, which is that type of graphics that is seen as a basic and self-contained branch that seeks to integrate technology innovations in addition to the artistic and creative sense in presenting information in a brief and coherent manner. It is interesting and thus is one of the basic sciences which combines technical and educational development (Al-Zahrani, 2017). Infographics are one of the latest educational technology technologies, as it showed the importance of the image in the educational and learning process and its prominent role in facilitating the delivery of information and the survival of its impact for a longer time, due to the different senses it addresses to learners. The way of assembling the picture and the word together with its consistent colors and shapes so that it attracts the attention of the students and works to stimulate their thinking by employing their sense of sight in perceiving and extracting the information contained in the pictures, drawings, colors and lines and converting it into a written verbal language. Based on the foregoing, the problem of the current research focused on analysis of the physics book for the 3rd intermediate grade according to the criteria for designing and producing infographics.

Significance of the Study

Since the science of physics plays an important role in most fields, and is even considered one of the main fields in technical development and in theoretical and applied sciences, and its areas of spread are very wide, which achieves leadership by virtue of its research in the universe with its phenomena and matter with its details (Abu Jahjouh, 2013: 179Science curricula in the modern era are dynamic and rapidly

changing curricula that exploit the capabilities of science and technology and their uses in the lives of individuals as a basis for their contents, and aim to prepare a citizen who is receptive to change and development, who is fluent in using the tools of science and has the basic skills that are among the most important things that we should arm every citizen with, for these curricula must be subject to experimentation, continuous evaluation, and modification in line with the rapid developments and changes in this era, and the latest developments in practical education (Hassan, et al., 2021). Pulak & Tomaszewska (2011), showed that "as a result of the accelerated knowledge and the huge amount of information in the current era and the urgent need to organize and systematize the information environment and the continuous development of teaching and learning methods, the need to use visual methods has emerged, and infographics are instrument for visually representing data, information, and knowledge" Quoted from (Hassan, 2017:61) Shaltout (2016) indicated, “Visual expression is familiar to us, as it is one of the common uses and one of the important and basic means in shaping the mental image and processing it in ordinary life, as he indicated that visual forms are important for representing knowledge not only as guiding and educational tools, but as features that link thinking and learning, and this is what It appears clearly in the art of infographics” (Shaltut, 2016: 20) With the development of the concept of the curriculum, where the role of the book was not limited to providing information only, but rather exceeded that much, therefore it became very necessary to subject these books to continuous evaluation, reflecting the meaning of reform, development, modification and improvement, as well as providing those in charge of this process with a clear picture of the suitability of these books and its ability to achieve the desired educational objectives.

Objectives of the Study

The objective of this study is to analyze the content of the physics textbook for the 3rd intermediate grade according to the criteria for the design and production of infographics, by answering the following questions:

1- What are the criteria for designing and producing infographics in the light of which the content of the physics textbook for the 3rd intermediate grade can be analyzed?
2- What percentage should be met for the criteria for designing and producing infographics in the content of the physics textbook for the 3rd intermediate grade?
3- To what extent are the criteria for designing and producing infographics available in the content of the physics textbook for the 3rd intermediate grade?

Limitations of the Study

The current study is limited to the content of physics textbook for the 3rd intermediate grade, eleventh edition (2021).

Definition of the Terms

(1st) CriteriaIt is defined by Arafa (2006), "A set of agreed terms and conditions, through the application of which the strengths and weaknesses are identified in what is to be evaluated and a judgment is issued" (Arafa, 2006: 45). Procedural Definition of the Criteria:A set of conditions and skills that must be available in the content of the physics textbook for the 3rd intermediate grade, on the basis of which the quality of drawings and shapes in the books will be judged.(2nd) Infographics

Which are defined by:

1- Abdel-Basset (2015), "visual representations for presenting data, information, or knowledge. They aim to present complex information in a quick and clear manner, and have the ability to improve perception by employing graphics to enhance the ability of the visual system of the individual to recognize patterns and trends. The process may be called infographics production labels: data representation, information design and preparation, or information architecture" (Abdel-Basset, 2015: 28).
2- Abu Zaida (2016)," Merger of the two terms that is the basis of (Information) meaning information and facts, and (Graphic) meaning pictorial, and accordingly it means pictorial data, as it can be called informational designs, and infographics in general refers to transforming complex information and data into visual graphics that are easy for the viewer to understand clearly and interestingly without the need for advanced reading, which provides effective visual communication between both the sender and the receiver" (Abu Zaida, 2016).
3- According to Shaltout (2016),The art of transforming complex data, information, and concepts into images and graphics that can be understood and assimilated with clarity and suspense.

Procedural Definition of the Infographics: The researcher adopted the definition of Shaltut (2016), as the procedural definition.

Theoretical Framework

1- Content Analysis The purpose of the content analysis is to highlight the strengths and weaknesses of the curricula and textbooks in order to review them and provide a basis for their modification. Providing assistance to authors, editors, and publishers in preparing new textbooks by providing them with directives and scientific principles in the light of the educational reality. Finding a balance between the content of the textbook or educational material and the students' tendencies and interests. Providing helpful materials in the review process, preparing teachers and administrators, and selecting textbooks and educational materials (Hassan, et al., 2021: 351)

2- Textbook

The value of the book for the teacher and the learner increases by the amount of effort expended in writing and directing it. Given the importance of the textbook, the responsibility for writing and directing it in the Arab world has become a responsibility of the Ministry of Education (Alhila, 2012: 257). Al-Issawi and others (2012) pointed out the importance of the textbook and its many functions, including Enriching and enhancing student learning as well as helping them to meet their self-needs within the scope of their life and professional reality and the capabilities of their educational environment. His theoretical and practical competencies, as well as acquiring sound study habits. It develops the students' ability to think in all its types and levels if it chooses its educational content well (Al-Issawi et al., 2012: 125).

3- The Criteria Youssef (2002) defines criteria as "the highest levels of quality in performance and specifications that can be reached, and on the basis of which the levels of performance and different specifications for anything are evaluated and then a judgment is issued on them" (Youssef, 2002: 504

One of the most important reasons for adopting criteria in the educational process is due to their importance in improving performance in the educational work system in all its aspects. Achieving the principle of total quality, reflecting the growth and service of society, meeting its changing needs, circumstances and issues, and confronting scientific and technological changes and developments, while at the same time serving the prevailing laws and taking into account the customs and ethics of society(Hassan, et al., 2021: 351) It also contributes to building an evaluation that has a high degree of stability and helps to track the development of students' performance and then judge their progress towards achieving the desired standards. It also identifies the various aspects of performance that should be focused on during the teaching and evaluation processes(Alsoub, 2021).It also contributes to the development of courses in the future by adopting the best current practices, which means its contribution to understanding what is behind the obstacles of the current structures of schools to move towards common horizons of excellence and to move the current level of performance to the desired level of performance (Mahmoud, 2006: 452-454).

4- Infographics Infographics are considered as a visual stimulus that has the ability to improve and increase understanding because it does not depend on written verbal language only, but also on images and shapes by combining written language and visual representation of information, thus making the information processing process easier and faster (Al-Mallah & Al-Hamid, 2018: 105) Krum (2013) defines infographics as design pieces that may include visualizations of data, illustrations, text, and images together in a format that tells a complete story (Krum, 2013:6). As a result, visual images have the potential to be an effective, accurate, and clearer means of communication than oral. Text alone and images can also aid in cognitive processing by providing context or metaphor. When used effectively, visual images help people understand abstract and complex information, especially when it is unfamiliar. people and do not have a pre-existing mental model to help make sense of new information (Dunlap & Lowenthal, 2019). Bellato (2013) links infographics with the well-known Chinese proverb, a picture is worth a thousand words. He believes that infographics take a traditional text of information, images, and graphics and present it visually, where the elements unite with each other to form a harmonious format that is easy to understand and assimilate. Infographics are learning tools that can be adapted to any educational environment as they enhance the learning experience of students. Among the benefits of learning associated with infographics are improving understanding of information, ideas and concepts, enhancing the ability to think critically, developing and organizing ideas, in addition to improving retention and recall of information (Bellato, 2013) quoted from (Islamoglu et al., 2015: 35).

4.1- Features of the Infographic Researchers such as Abdel-Basset (2015), Alsoub (2021), Davis & Quinn (2013), and Kenner (2014) have presented many important advantages of infographics in that it gives more visual interest to information so that it is more clear, shows information represented graphically, and simplifies complex information and makes it, and it is easy to understand and relies on visual effects in communicating information, quoted from (Alsoub, 2021: 421; Cheta, 2018: 84) Converting information and data from boring numbers and letters to interesting pictures and graphics, and shortening the time, instead of reading a huge amount of written data that can be visually scanned easily, and it is used in marketing through social networking sites for advertising, and this type is also used among the drawings is a code embedded within the website or blog page, which reduces pressure on the Internet compared to regular graphics and images, and the ease of publishing and spreading infographic through social networks, and enhancing the ability to think, link and organize information, and help to retain information for a longer time, and the applicability to a number of a large number of specializations and different areas of data such as images, numbers, texts, and thus helps the infographics to retrieve information easily and easily at the time of need (Alsoub, 2021: 421; Cheta, 2018: 84).

4.2- Infographics DesignDesign requires defining the idea that we want to present to individuals in a simple, easy, attractive and exciting way, and searching for reliable sources for the idea that we want to present and documenting the drawings with the selected sources below the design so that there is credibility by people when observing and reading information related to the desig In addition to making a preliminary drawing and visualization of the drawing, in which the main and sub-headings such as the general shape, colors, the nature of the design, the coherence of the basic structure of the design, and linking each part of the image to the one before it are determined so as to ensure the display of a clear digital story with the interconnected visual narration to achieve a specific meaning. Finally, focusing on the visual elements more than the written ones in the infographic, while choosing the appropriate colors for the design (Smiciklas, 2013).

Methodology

1-Choosing the research metho The researcher used the descriptive analytical approach to analyze the content of the physics book for the 3rd intermediate grade according to the criteria for designing and producing infographics, due to its suitability to the nature of the research for the purpose of achieving its objective.

2- Determine the research communit The current research community is determined by the approved physics textbook of 3rd intermediate grade, academic year 2021-2022, the eleventh edition of the year (2021), and the number of pages that were subjected to the analysis process (157).

3-The research sample The research sample included all the drawings, shapes, charts, and images included in the content of the physics textbook of the 3rd intermediate grade, approved for the academic year 2021-2022, except for questions and indexes.

4-The research instrumentAfter reviewing a number of literature, books and previous studies that dealt with the criteria for designing and producing infographics, including the study of Hassan and others (2021), Hassan (2017) and Shaltout (2016), and to achieve the objective of the research, the researcher adopted the research instrument, which is a list of criteria for designing and producing infographics. In the study of Hassan and others (2021), which consists of two areas (the educational design of infographics), it contains three main criteria and (14) sub-criteria. And (the technical design of the infographics contain (7) main criteria and (37) sub-criteria, and accordingly the research instrument consisted of (10) main criteria and (51) sub-criteria as shown in Table (1) and Appendix A. Table (1) List of the Criteria for Designing and Producing Infographics (fixed)

Field	Sequence	Main Criteria,	Number of indicators
(I) The educational design of the infographics (fixed), which takes into account:	1	Specific educational objectives	4
	2	Provide clear and specific content	7
	3	Consistency with the characteristics of the learners presented to them	3

(2) The technical design of the infographics (fixed), which takes into account:	4	Simplicity in design	7
	5	Good output	6
	6	Employ fonts correctly	3
	7	Use colors appropriately	5
	8	Employ graphics and shapes appropriately	5
	9	Proper use of text	5
	10	Good coordination of the design structure of its elements	6
The total			51

5- Determine the criteria of analysisFor the purpose of issuing an objective and accurate judgment, accurate and reliable criteria should be available, and the researcher adopted the analysis criteria mentioned in the study of Hassan and others (2021).

6- Analysis procedures The physics book for the 3rd intermediate grade was analyzed by adopting the two steps of the analysis next:

1- General reading of the contents index of the book and the contents of each chapter.

2 -Read the titles of the drawings, shapes, charts and images included.

3 -Examining the contents and vocabulary of drawings, shapes, charts, and pictures to ensure their relationship to the academic content attributed to him.

4- Determine the type of idea involved.

5- Categorizing the idea under the field and the main and sub-criteria specified in the analysis list and giving one repetition for each appearance of it.

6- Empty the results of the analysis into the analysis instrument, and then calculate the percentages of recurrences.

Presentation and Interpretation of Findings

The aim of this research is to analyze the content of the physics book for the 3rd intermediate grade according to the criteria for designing and producing infographics, which can be achieved by answering the following question:

1 -What are the criteria for designing and producing infographics in the light of which the content of the physics textbook of the 3rd intermediate grade can be analyzed? A list of criteria for designing and producing infographics are prepared according to the aforementioned procedures by Hassan and others (2021). Which consisted of two areas; The first domain contains (3) main criteria and (14) sub-criteria, while the second domain contains (7) main criteria and (37) sub-criteria, as shown in Table (1) and Appendix A.

2 -What percentage should be met for the criteria for designing and producing infographics in the content of physics textbook of the 3rd intermediate grade?After unpacking the questionnaire addressed to the experts about determining the percentages of the criteria that should be characterized by the infographics (fixed) included in the content of physics textbook of the intermediate stage (criteria).And calculating the average for the experts' answers, the proposed ideal findings were as shown in Table (2).Table (2) The Average Ideal Percentages for the Included Criteria in the Content of Physics Textbook for the 3rd Intermediate Grade, According to the Opinion of Experts

Field	Sequence	Main Criteria	Average Ideal Percentages of the Criteria
(I) The educational design of the infographics (fixed), which takes	1	Specific educational objectives	%9
	2	Provide clear and specific content	%7
	3	Consistency with the characteristics of the	%8

		learners presented to them	
(2) The technical design of the infographics (fixed), which takes into account:	4	Simplicity in design	%10
	5	Good output	%11
	6	Employ fonts correctly	%7
	7	Use colors appropriately	%13
	8	Employ graphics and shapes appropriately	%15
	9	Proper use of text	%8
	10	Good coordination of the design structure of its elements	%12
The total			%100

3- To what extent are the criteria for designing and producing infographics available in the content of the physics textbook for the 3rd intermediate grade?In order to answer this question, the list of criteria are prepared for monitoring the frequency of the indicators that includes in each drawing, chart, shape, or image in the chapters of the physics textbook for the 3rd intermediate grade, which contains (234) drawings and shapes and a plan and a picture, and by adopting and matching the list of criteria, these drawings, shapes, charts and pictures showed the findings as shown in Table (3).Tab The Total of Frequencies and Percentages of the Achieved Criteria

Field	Sequence	Main Criteria	Frequency	Percentage	Percentage of Field
(I) The educational design of the infographics (fixed), which takes into	1	Specific educational objectives	500	7.6%	25.7%
	2	Provide clear and specific content	833	12.6%	
	3	Consistency with the characteristics of the learners presented to them	362	5.5%	
(2) The technical design of the infographics (fixed), which takes into account:	4	Simplicity in design	960	14.5%	74.3%
	5	Good output	770	11.7%	
	6	Employ fonts correctly	333	5%	
	7	Use colors appropriately	780	11.8%	
	8	Employ graphics and shapes appropriately	710	10.7%	
	9	Proper use of text	610	9.2%	
	10	Good coordination of the design structure of its elements	752	11.4%	
The total			6610	100%	

Table (3) showed that the first field obtained a percentage of (25.7%), and that the second criterion received the highest percentage (12.6%), followed by the first criterion (7.6%), then the third criterion (5.5% As for the percentage of the second field, it constitutes (74.3%), and the fourth criterion received the highest percentage (14.5%), and the sixth criterion had the lowest percentage (5%).When comparing the results of the analysis of 3rd grade intermediate textbooks with the ideal percentages of experts, we find that there is no agreement between them, whether in the percentages of the two fields or the percentages of the criteria.

Conclusion

In light of the research findings, we conclude the following:

1- The physics textbook for the 3rd intermediate grade did not achieve any percentage from percentages of the ten main criteria for designing and producing infographics.
2- The third criterion in the first field(the educational design of infographics) is the least achieved, which is percentage (5.5%).
3- The sixth criterion(employ fonts correctly) in the second field (the technical design of infographics) is the least achieved, which its percentage (5%).
4- The fourth criterion (simplicity in design) in the second field (the technical design of infographics) is the most fulfilling of the criteria for designing and producing infographics, which its percentage (14.5%).
5- There is randomness in the percentages of the criteria for designing and producing infographics, which are included in the textbook.

Recommendation

Based on the findings and conclusions of the research, the researcher recommends the need to employ all the energies and experiences of those interested in the field of curricula in preparing and developing modern curricula that keep pace with the scientific developments taking place in various aspects of science and knowledge. Paying attention to educational technology, of which infographics are the most important tools and employing them in the development of physics textbooks, which simplify complex and boring concepts and turn them into pictures, drawings, shapes, charts, and interesting elements that interest students The researcher also recommends the involvement of professors with specialization in educational technology in the committees for authoring physics textbooks, with interest in the artistic output of drawings, shapes, charts and images, with the establishment of training courses for them centered on the designing and producing infographics to be used during their teaching. The curricula of the faculties of education and the faculties of basic education.

Proposals

1- Developing a proposed unit of study in physics according to the criteria for designing and producing infographics, and determining its suitability for the level of students.
2- A study that reveals the effect of employing infographics on increasing student achievement in physics.
3- A study revealing the extent of knowledge and familiarity of physics teachers with infographics technology and its use in teaching.

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Appendix A List of the Criteria for Designing and Producing Infographics (fixed) and their Indicators

Main Criteria	Sequences	Indicators	Frequency	The total
Specific educational objectives	1-1	Objective is clear and specific.	130	500
	2-1	Objective is related to the type of information to be included.	120	
	3-1	Objective is commensurate with the abilities of the students.	100	
	4-1	Compatibility of the objective with the objectives of the course.	150	
Provide clear and specific content	1-2	Free from linguistic and scientific errors.	170	833
	2-2	Modern.	90	
	3-2	It covers all parts of the idea.	110	
	4-2	Accurate and clear.	123	
	5-2	Appropriate to the level of learners.	100	
	6-2	Avoid unimportant information.	80	
	7-2	It is presented in a way that attracts the attention of the learner and attracts his admiration.	160	
Consistency with the characteristics of the learners presented to them	1-3	The infographic design is suitable for the mental level.	110	362
	2-3	The design is commensurate with the preparation and age of the student.	120	
	3-3	The design is commensurate with the capabilities of the students and their knowledge backgrounds.	132	
Simplicity in design	1-4	The infographics is clear and uncomplicated.	200	960
	2-4	It presents the idea in an integrated and smooth manner.	120	

	3-4	Avoid overlapping ideas.	90	
	4-4	Focus on just one idea.	100	
	5-4	Avoid artistic dazzling.	110	
	6-4	Helps retain the effect of teaching and learning.	190	
	7-4	Contribute to the delivery of the educational message.	150	
Good output	1-5	The infographics presents its elements in a coherent and integrated manner.	70	770
	2-5	The infographics is innovative and unique.	100	
	3-5	The infographics presents the idea in a way that integrates texts with graphics.	110	
	4-5	The infographics appears aesthetically and attractively.	160	
	5-5	The main title is distinct, commensurate with the content.	130	
	6-5	It is characterized by attractive colors and consistent with the idea and purpose of the infographics.	200	
Employ fonts correctly	1-6	The clear font that integrates with the content and helps to read it.	143	333
	2-6	Two types of fonts are used as a minimum to distinguish titles from content.	90	
	3-6	Infographics use spacing and division of lines to distinguish sections of content from each other.	100	
Use colors appropriately	1-7	Attractive colors and proportional to the content.	170	780
	2-7	Colors help evoke desirable effects and receive and understand the message.	160	
	3-7	Using neutral colors for the background.	100	
	4-7	البعض Simplicity in choosing colors and being consistent with each other.	150	
	5-7	Economy in the use of bright colors.	200	
Employ graphics and shapes appropriately	1-8	Graphics characterized by visual quality and correct depiction of data.	90	710
	2-8	Graphics related to the themes mentioned in the design.	190	
	3-8	Graphics encourage analytical and multi-dimensional thinking.	110	
	4-8	The size of the graphics is proportional to the size of the content displayed within.	200	
	5-8	Graphics detail is clear.	120	
Proper use of text	1-9	The text is easy to read.	160	610
	2-9	Using words in interesting ways.	110	
	3-9	Using short, concise sentences and paragraphs to describe items carefully.	150	
	4-9	Using bold letters and headings to make certain words stand out.	90	
	5-9	Using census to show sub-points.	100	
Good coordination of the design structure of its elements	1-10	Distribute the elements in a balanced manner and invest all the space.	150	752
	2-10	Focus on visual forms more than writing.	190	
	3-10	Determine the scale for the elements that take visual priority within the design.	122	
	4-10	It takes into account unity of the colors of the components for design.	100	
	5-10	Choose an attractive title for the design.	100	

	6-10	The size of the design is proportional to the idea presents.	90	

Appendix Questionnaire to Determine the Percentages of the Criteri

Field	Sequence	Main Criteria,	Percentages of the Criteria
(I) The educational design of the infographics (fixed), which takes into account:	1	Specific educational objectives	
	2	Provide clear and specific content	
	3	Consistency with the characteristics of the learners presented to them	
(2) The technical design of the infographics (fixed), which takes into account:	4	Simplicity in design	
	5	Good output	
	6	Employ fonts correctly	
	7	Use colors appropriately	
	8	Employ graphics and shapes appropriately	
	9	Proper use of text	
	10	Good coordination of the design structure of its elements	
The total			100%