INFOGRAPHICS IN EDUCATION: REVIEW ON INFOGRAPHICS DESIGN

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ABSTRACT

One way of handling significant amounts of information is through visual. The infographics can transfer knowledge about a topic faster and more effectively than pure text; however, this condition is depending on the quality and presentation of the infographics. This paper is intended to investigate infographics in various areas and then focusing on its application in education. Besides, designing aspect of infographics was explored since it is important for designing good quality of infographics application. To achieve this objective, a total of 55 articles from four databases covering the period from 2004 to 2016 were analyzed based on their setting. The analysis showed that 30 articles discussed the infographics, eighteen articles elaborated infographics in education field, and seven articles immersed on infographics design. Infographics design techniques in various areas can be implemented in designing a good infographics application for teaching and learning purposes.

KEYWORDS

Infographics, Infographics in Education, Infographics Design

1.INTRODUCTION

Studies show that the utilization of modern technologies in classrooms gives learners the opportunity to learn faster with better function and with more satisfaction from their class attendance. The attraction of infographics seems to be inherent within their nature, since people are drawn to the visualizations, colors, and images of the infographics itself. An infographic can transfer knowledge about a topic faster and more effectively than pure text; however, this condition is depending on the quality and presentation of the infographics.

Infographics have permeated the culture as a leading form of information display and communication. They can be seen everywhere from business and news to social media websites. Infographics are also unique visualization, since they combine beautiful visualization with an impactful way to deliver direct information and also can be used as the learning tool in education for teachers and students. It has been demonstrated that infographics can be used to advise non-expert audiences so they can make informed decisions about what messages they want to deliver based on their own needs.

Infographics are considered as a part of information visualization. It is a research field that focused on patterns and trends in abstract data sets and can support for designing infographics to have maximal effect. The field of information visualization is combining concepts from computer science, data mining, cognitive science and graphic design. This is relevant as the ability to collect, store, and manage data is increasing quickly, our ability to understand it remains relatively constant.

Infographics is data visualizations that present complex information quickly and clearly which includes signs, photos, maps, graphics and charts. Infographics are visual representations that integrate information derived from data and graphics to convey a message. These visualizations are frequently used to aid in data interpretation. Currently, design guidelines for infographics exist broadly under the umbrella of several disciplines that include semiotics and graphic design

[1]. As educators, using and creating infographics will develop visual literacy skills, which will help the teachers to teach the students to make sense of and evaluate visual information. Additionally, through the activity of designing a visual representation of complex ideas, they will engage with the content in a sustained manner, possibly deepening their understanding of it [2].

The design of infographics should be experienced to carry transmission of data visualization, design details that reflect the data correctly and an attractive and understandable general design will fulfill the main function of infographics. Good infographics design is about storytelling by combining data visualization design and graphic design.

In infographics design, the Picture Superiority Effect is extended to include charts, graphs, and data visualizations. Infographics designers use data visualizations and illustrations as the visual component of a design to trigger the Picture Superiority Effect, which can have incredible success getting the audience to remember the information presented. Many of the good infographics follow a simple three-part story format: introduction, key message, and conclusion.

The infographics creators should consider the foremost structure, accuracy, reliability, depth, and functionality and then think about decoration. Infographics need analyzing, evaluation, and creation. To present the huge information in a large set of data, graphs and statistical chart or geographical context to a story with a map need to be applied. These infographics are called as the data visualization tools [3].

Infographics can be used when the students want to get across a big idea, or make a point to learners. Concepts that are tricky for learners might lend themselves well to infographics. Or, if they have facts that are hard to learn, the researcher might investigate how they might be turned into infographics. Infographics can be broadly categorized into the following: comparison, flow chart, timeline, process, image-based, data, narrative, metaphor, combination, and other. Many of the infographics can be considered background reading for the course and may be helpful as the students complete their future assignments [4].

This research is different with the previous studies since it was investigating the use of infographics, infographics in education field, and infographics design. It enables the researchers and others to know more about the infographics within the use and the design. This is because the teaching and learning process can be more interesting and understandable by the students. However, this research provides an in-depth discussion of current efforts to investigate those three aspects.

2. METHODOLOGY

The research method of this study was based on a critical review of related literature involving 4 databases and 55 articles published from 2004 to 2016. Specifically, the survey only focused on articles that were written in English and taken from various databases.

2.1 Information Sources

The databases that have been used for the information sources in this research are: (1) IEEE, (2) Science Direct, (3) Research Gate, and (4) Google Scholar. These databases were based on their technical relevancy that highlights the overall description of the research area involving infographics, infographics in education field, and infographics design.

2.2 Selection of Studies

The selections of studies have through some processes, such as the search of information sources based on specific keywords that were connected with the research being proposed. The databases that had been collected was combined to produce a list of all articles that were connected to the

research. Next, these articles were going to two phases of examination and filtering process. In the first phase, information of the articles were checked and filtered based on the articles' titles and abstracts to select relevant research articles. Duplicated articles and articles that did not fulfill the criteria were discarded from the list of shortlisted articles. Subsequently, for the next phase, the selected articles were reviewed, tested for their connectivity (through detailed reading of the main texts), and finally filtered according to the same selection criteria.

2.3 The Search

The process of searching the information is by using the "search box" of the 4 databases. The first keywords that were used to find the databases starting from general terms, both of them are "info graphics" and "infographics". After that, the researchers tried to find another keywords to come to the specific field, they are "infographics education" or "infographics in education" or "infographics in education fields", or "infographics focusing in education" or "education using infographics media". Then, the resercher have idea about some new more specific purposes, they are "the principle of designing infographics" or "how to design infographics" or "what the aspects to design infographics" or "guiding to design infographics", or "infographics guidelines" or "the design aspects in infographics education" which were specific to the study being undertaken. The limitation of the search for articles was based on the years of publication of studies for twelve years, which was from 2004 to 2016, to highlight the recent development in research involving the investigation of three things. Moreover, the focus of search is also limited to searching peer-reviewed journal articles and conference proceedings given their high degree of scientific and technical quality. Such sources of information were highly reliable given the brief and clear review process by experts prior to their acceptance to appear in such journals or proceedings.

2.4 Selection Criteria

Actually, the selection of articles have two criteria, namely "acceptance" and "rejection". After casting aside duplicated articles from the information sources, the checking process of articles was performed in cycles based on the above criteria (i.e., acceptance and rejection). The acceptance criterion, which had been determined, was as follows: (a) articles must only be written in English, and (b) the discussion in the articles must only relate to infographics in general, infographics in education, and infographics design. Whereas, the rejection criterion was as follows: (a) articles that were not written in English, (b) the discussion in the articles are not related to infographics in general, infographics in education, and infographics design. Then, the researchers highlight the overall description of the current efforts and studies involving the infographics in general, infographics in education field, an infographics design.

2.5 Data Collection Process

In the data collection process, information connecting to the selected articles was organized into a table using the Microsoft Excel application. Articles were classified into appropriate categories to facilitate the process of organizing studies based on specific themes/topics that have been mentioned before.
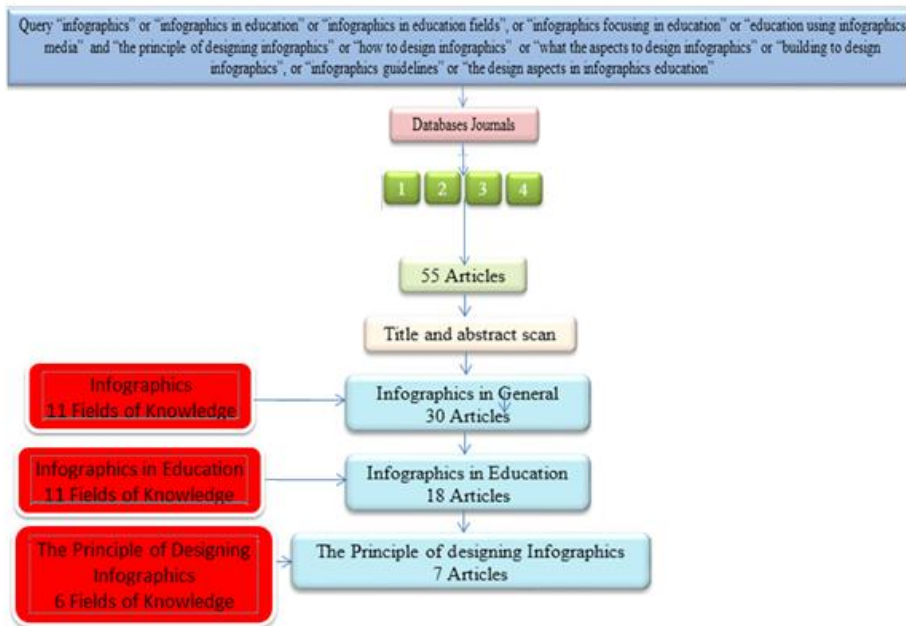
Figure 1. Journal Databases

3.RESULTS AND DISCUSSION

3.1 Results of The Research

The total numbers of the articles that the researcher collected were 55 articles. The table below is the explanation of the number of the articles for each database.

Table 1. The databases that are used for this research

NO	DATABASES	THE NUMBER OF ARTICLES
1	IEEE	17
2	Science Direct	2
3	Research Gate	3
4	Google Scholar	33
The Total Number of Articles		**55**

A majority of the articles, 33 were obtained from Google Scholar database and 17 articles appearing in IEEE. In addition, there were three articles from Research Gate and in Science Direct database there were two articles was connected with the infographics.

There are some journals that have been collected from those databases such as, Association for Computing Machinery, European Journal, Indian Journal, Journal of Applied Linguistics and Language Research, Journal of Art And Humanities, Journal of Pedagogic Development, Online Journal for E&P Geoscientists, Online Journal of Art And Design, Sage, Turkish Online Journal, International Academic Journal of Innovative Research, Scientific and Engineering Journal for Construction and Architecture, Scientific Research Publishing, Master Thesis, selected paper of educational government, Doctoral dissertation, The Electronic Data Methods Forum Community, Signata, The International Academic Forum, and The Science Teacher.

These articles would then be subjected to further analysis to acquire a complete description of studies that have been carried out in this field. The final set of selected articles was then subjected to contents analysis of the manuscripts by thorough reading to help classify the articles into appropriate categories.

Based on the explanation above, the researchers have categorized three types of the discussion about the infographics, they are: (a) infographics, (b) infographics in education and (c) infographics design. In addition, it also written the year of publications for each article based on its databases.

The table below is about the year of publication of 55 articles that published in four databases that related to three categories of infographics.
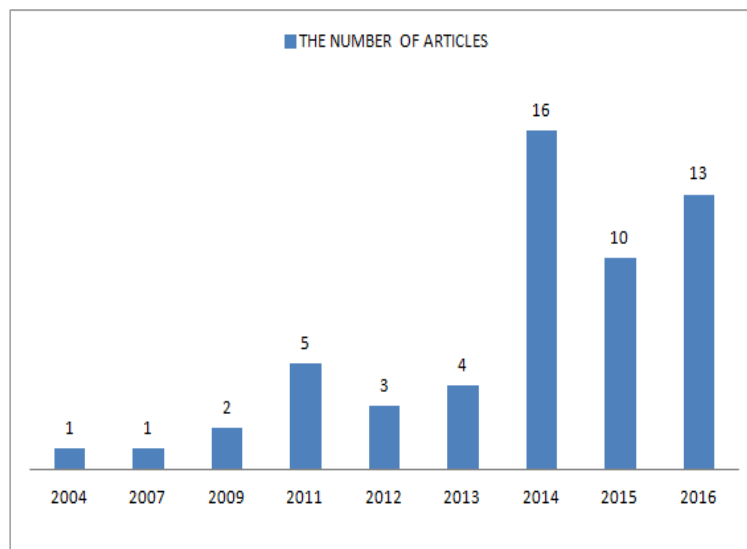

Figure 1. The Articles Based on The Year of Publication

From the figure above, it can be seen that in 2014, there were sixteen articles and thirteen articles in 2016. In 2015, ten articles contributed for this research about the infographics and five articles in 2011. Furthermore, there were three articles in 2012 and two articles in 2009 related to this research topic, and the last in 2004 and 2007, there was one article for each year respectively discussed the matters of theme.

For the category which focused on the infographics, the articles that have been classified are from the engineering and technology, communication, health, computer graphics, socio technical system, computing systems, information management, geoinformatics, media, public relations, and biomedical sciences. Furthermore, for the discussion of the infographics in education field, the total article under this category involves educational computer, instructional technology, technical drawing, technology, linguistics, industry, chemistry, science, and engineering, technology, and mathematics fields. The last one, the discussion contained the infographics design and infographics application in various categories such as games, health, science, technology, learning sciences, and economics.
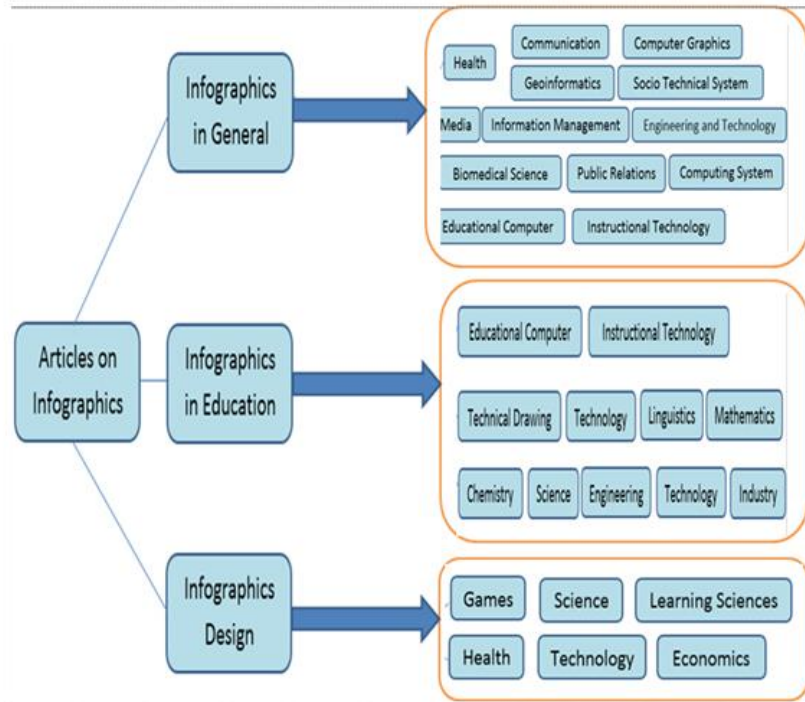
Figure 3. A Taxonomy of Research Literature on Infographics

Based on the taxonomy above, the researchers have found the information about the years of publication and the fields of infographics. It can be concluded that in 2014 has contributed seven articles for the research, and there were five articles for each year in 2015 and 2016. In 2011, there were four articles, and in 2013 it has been found three articles and for 2012 there were two articles. In 2004 and 2007, there was only one article which dealt with the general infographics respectively. For the category of infographics in education, the number of articles in 2014 and 2016, there were seven articles for each year, in 2015, there were two articles, and in 2012 and 2013, just one article respectively. The last one, in Infographics design, there were three articles in 2015, two articles were found in 2014, and in 2011 and 2016, there was only one article for each year. The graphic below explained more about the data.
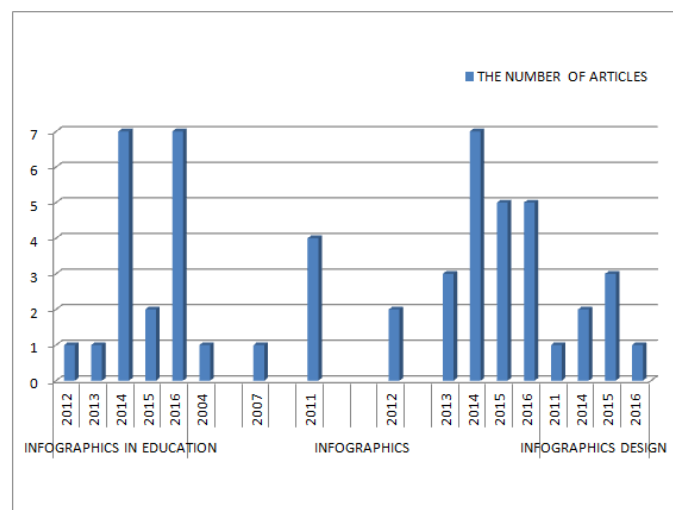
Figure 4. Infographics Categories and The Year of Publication

The final analysis revealed that (32.72%) eighteen articles discussed the infographics in education field. On the other hand, 30 articles (54.55%) focused on the discussion of general infographics. The last seven articles (12.72%) contained the infographics design.

3.2 Discussion of the Research

This research focusing on the literature review in infographics, infographics in education, and infographics design and the researcher reviewed 55 articles from four databases from 2004 to 2016. The result of the research revealed that using and creating infographics will develop visual literacy skills, which will help the teachers to teach the students to make sense of and evaluate visual information. The infographics creators should consider the foremost structure, accuracy, reliability, depth, and functionality and then think about decoration. Infographics need analyzing, evaluation, and creation.

There are several studies of infographics that have been done by the previous researchers dealing with the use of infographics, in education, and designing infographics.

Some researchers such as [5-7] analyzed the infographics use in general. They discussed about on how to apply infographics in teaching, for instance in Advanced Learning Technologies, Technology Management, Curricula and Teaching Method, Design Education, Applied Psychology, Applied Psychology, General Knowledge. In education field, for example [8-13] conducted the studies on the effect of infographics in different field such as Agricultural Science, Health Education, Algorithms, Geographical Information Science, Education, and Science, Technology, Engineering, Mathematics (STEM). They want to measure the effectiveness of using infographics in the classroom by designing infographics.

Learning styles and enjoyment of the information affect infographics perception and they investigate how infographics affect learning and how individual factors, such as learning styles and enjoyment of the information affect infographics perception. This research is also comparing the use of graphics and infographics for robust learning and searching for the relationship between these two things as the instructional media. The effect of infographics toward learning and individual infographics really can support the teaching and learning process of Robust learning selected the infographics from many resources and general topics of infographics. Students who used infographics keep their acquired information longer than students who only used graphics text and other researcher can replicate the study by using a larger sample of students show statistical difference between students using graphic text and students using infographics [14].

Improve the design education in delivering the materials for the students' design education, how to apply infographics in education design it describes the steps to apply the infographics in the classroom. They analyze the relationship and apply the infographics in the classroom. There are three steps for applying infographics in education field Knowledge conversion, choosing the right colors, and tell the story. The students can be the real designer and applying this new method [15].

Enrich data expressions greatly to make the visualization of spatial data and to accommodate more character expressions by combining traditional thematic maps and infographics and it is called geoinfographics. It can be used as the tool in new technology environment as the innovation for visualization expressed in infographics design. It is new cartographic visualization methods, evolution of spatial data expression new trend of representing spatial data, expanding study of expressing spatial data, analyses the concept and construction of traditional thematic

maps combining with principles and methods of infographics. It suggests showing the data of teaching and learning process in a way of better visual cognition [16].

The principle of designing Infographics and the complexity of the infographics design have also been studied. Infographics designers use data visualizations and illustrations as the visual component of a design to trigger the Picture Superiority Effect that include charts, graphs, and data visualizations which can have incredible success getting the audience to remember the information presented. A good infographics follow a simple three-part story format: introduction, key message, and conclusion [17-21].

There is advantage of using visualization tools over traditional method of teaching, there is a strong relationship between student performance in exams and students' evaluation of visualization tools and use other visualization tools for enhancing students' understanding in university level [22].

The educators have to keep up with current technology and learning styles, the use of infographics can be a useful tool in the classroom for difficult subject for the students and as a course material in all other challenging lessons [23].

The conventional form of lectures might be possible to transform towards easy understandable courses by having much more infographics. The educators can extend the learning for the construction of elaborations of multiple languages and written readings by using infographics and it can be very useful to make the abstract lessons are more concrete in teaching and learning process for the students to think critically.

The advancement of technology and the needs for the students to learn the materials that are difficult for them by using infographics as the visualization tool is an aim for this research. Very limited research is done on info graphics design, especially by the support on learning theory and theory of the content matters. The design of this visualization tools will help teachers and students to understand difficult and complex materials.

4.CONCLUSION

The researchers specifically integrated two aspects of infographics which are infographics and infographics in education that can be implemented in the classroom with a good design aspect. The contribution to the analysis of literature review on infographics design in education can become guideline to solve the problems in education by using infographics. This study can be used as reference or information to conduct further research to develop infographics as the instructional media. It is hoped to be beneficial for lecturers, students, and other researchers.

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REFERENCES

[1]   Rahim, N. N., Khidzir, N. Z., Yusof, A. M., & Saidin, A. Z., (2016) "An assessment of quality on animated Infographics in an islamic context", Proceedings 2016 IEEE international conference on teaching and learning in education (ICTLE 2016).

[2]   Matrix, S., & Hodson, J., (2014) "Teaching with infographics: practicing new digital competencies and visual literacies". Journal of Pedagogic Development, 4, 2.

[3] Krum, R., (2014) Cool Infographics: Effective Communication with Data Visualization and Design, John Wiley & Sons.

[4] Dalton, J., & Design, W. A., (2014) Brief Guide to Producing Compelling Infographics, London, London School Publishing.

[5] Agwa-Ejon, J. F., & Batchelor, V., (2016) "The acceptance of infographics for business performance and optimization", Management of Engineering and Technology (PICMET), 2016 Portland International Conference, pp1847-1858.

[6] Handaru, W. C., Mutiaz, I. R., & Prihatmanto, A. S., (2015) "Infographics application citizen daily reporting enabled participatory platform for citizen and government: the case of Bandung cities", Interactive Digital Media (ICIDM) 2015 4th International Conference, pp1-6.

[7] Albers, M. J., (2014) "Infographics: Horrid chartjunk or quality communication", Professional Communication Conference (IPCC) 2014 IEEE International, pp1-4.

[8] Ruini, L., Ciati, R., Marchelli, L., Rapetti, V., Pratesi, C. A., Redavid, E., & Vannuzzi, E., (2016) "Using an infographic tool to promote healthier and more sustainable food consumption: the double pyramid model by Barilla Center for food and nutrition", Agriculture and Agricultural Science Procedia, 8, pp482-488.

[9] Wang, Y., (2015) Designing Safer Sex Infographics: Framing Data with Emotional and Rational Appeals, Doctoral Dissertations.

[10] Ma, R., & Singh, G., (2004) "Large-scale infographic image downsizing", Image Processing ICIP 2004 International Conference, 3, 1661-1664.

[11] Kennedy, J., Abichandani, P., & Fontecchio, A., (2014) "Using infographies as a tool for introductory data analytics education in 9–12", Frontiers in Education Conference (FIE) 2014 IEEE, pp1-4.

[12] Hill, S., & Grinnell, C., (2014) "Using digital storytelling with infographics in STEM professional writing pedagogy", Professional Communication Conference (IPCC) 2014 IEEE international, pp1-7.

[13] Rezaei, N., & Sayadian, S., (2015) "The impact of infographics on Iranian EFL learners' grammar learning", Journal of Applied Linguistics and Language Research, 2, 1, 78-85.

[14] Lyra, K. T., Isotani, S., Reis, R. C., Marques, L. B., Pedro, L. Z., Jaques, P. A., & Bitencourt, I. I., (2016) "Infographics or graphics + text: which material is best for robust learning?", Advanced Learning Technologies (ICALT) 2016 IEEE 16th international conference, pp366-370.

[15] Ru, G., & Ming, Z. Y., (2014). "Infographics applied in design education", Advanced Research and Technology in Industry Applications (WARTIA) 2014 IEEE Workshop, pp984-986.

[16] He, M., Tang, X., & Huang, Y., (2011) "To visualize spatial data using thematic maps combined with infographics", Geoinformatics 2011 19th International Conference, pp1-5.

[17] Diakopoulos, N., Kivran-Swaine, F., & Naaman, M., (2011) "Playable data: characterizing the design space of game-y infographics", Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp1717-1726.

[18] Krejčí, M., & Hradilová, I., (2014) "Landscape infographic design, European Scientific Journal September 2014 special edition Vol.2 ISSN: 1857 – 7881 .

[19] Lee, M. H., (2015) "A Design of infographics by using MVC design patterns based on N-Tier platform", Indian Journal of Science and Technology, 8, 7, 618-623.

[20] Sommer, S., Graville-Smith, C., Polman, J., & Hinojosa, L., (2016) "Iterative curricular design of collaborative infographics for science literacy in informal learning spaces", Transforming Learning, Empowering Learners.

[21] Yani, A. R., Achidatunnisak, I., & El Chidtian, A. S. C. R., (2015) "Designing infographic book about the risk of free sex for teen girl by using religious approach", International Proceedings of Economics Development and Research, 83, 21.

[22] Naser, S. S. A., (2008) "Developing visualization tool for teaching AI searching algorithms", Information Technology Journal Scialert, 7, 2, 350-355.

[23] Sudakov, I., Bellsky, T., Usenyuk, S., & Polyakova, V., (2014) Mathematics and Climate Infographics: A Mechanism for Interdisciplinary Collaboration in the Classroom. arXiv preprint arXiv:1405.6435.

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