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SYSTEMATICAL OVERVIEW OF GOOGLE LENS EFFICIENCY DURING STEM CLASSES

Today the most of the studies devoted to theory of education, but only very few of them are devoted to providing of practical usage of them. Also, today, STEM-approach in education is a trend. To provide it, a lot of tools were recommended. For example, VR, AR tools, LMSs, VR tools, semantic and cognitive ontology tools, virtual modeling and calculation tools. Very perspective tools to provide immersion are AR tools. It was proved that Google Lens and Google expeditions are perspective tools to use under STEM education [1, 2]. Google Lens is a tool of AR that can be used during biology that of unique tools that are very effective. It can involve students to provide in studies during classes and after school time. Also, Google lens can be used in history, architecture, mineralogy, geology, engineering.

As alternatives, can be used also other android apps such as plant identifiers that can analyze photos (Google Lens, for example, PlantNet, Flora Incognita, PlantSnap, Picture This), plant classificatory that provides possibility to identify plants manually (for example, FloristX and What is a flower) and plants-care apps that remind to water up the plant or change the soil, which by the lower potential compared to other types of application (for example Manager of houseplants). However, the most student's immersion is provided by plant identifiers. Therefore, the study is related to analyze the efficiency of image processing by plant identifiers apps and its comparing.

Google Lens was characterized by the highest mark of usability compare to PlantNet and Flora Incognita. Flora Incognita correctly identified plant species in 71% case and PlantNet correctly does this in 55 % cases. Google Lens has provided

93 % successfully identifications. Therefore, Google Lens is the most recommended app to use during biology classes. However, for those students and teachers who do not like the Google Lens app, it is possible to use Flora Incognita.

The detailed analysis Google Lens image processing efficiency has been provided. Efficiency of the processing is growth with quality growth. However, even the low-quality photos still have a very high chance to be successfully identified. 85.7 % of photos with low quality were successfully recognized compared to 95.8 % of incorrect results in the case of high-quality photos. Google lens provided 80.8 % for high quality photos, 72.7 % for medium quality photos and 62.6 % for high quality photos.

It may be summarized that algorithms provided by Google Lens can efficiently process even low-quality photos enough fine. It means that Google Lens can be used for each school.

Google Lens algorithms better analyze flowers than other plants parts. Flowers identifications accuracy was 92.9 %. Worst results of the Google Lens analysis were under fruit analysis. It may be related different plants fruits similarity. Using fruits for identification was characterized by accuracy of 83.8 %. Totally correct recognition for leaves and fruits of the plants was 70.9, 70.5, 70.3 %, respectively.

Therefore, it seems relevant to provide analysis of the flowers of the plants to get better results.

Much worse Google Lens results were characterized for bushes. Google Lens totally accurate analysis was provided for 74.4 of grass samples, 76.4 of trees sample. The inaccuracy of it was 10.4 % and the quantity of totally correct results was 64.6 %.

It worth note that, a method of usage of Google Lens during STEM-education is available on stemua.science web-page [3–5]. However, Google lens is limiting by both, pedagogical aspects and technical problems. Pedagogical aspects are a lack of teacher's awareness of this instruments, lack of the methodical achievements and their absence of Ministry of science and education recommendation about it. The main

technical problem is high equipment cost of the Lens supported stuff, there some mistakes of under working.

Today, the study's results are widely used today for both, providing of education [6] and biology studies [7–10]. Generally, the tendencies noted before is useful to provide realization of STEM approach and be knowledgeable during choosing of image processing tools to use during classes and after class time.

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ТЕОРЕТИЧНІ АСПЕКТИ ФОРМУВАННЯ ТА РОЗВИТКУ ІННОВАЦІЙНОЇ ЕКОСИСТЕМИ СУЧАСНОГО УНІВЕРСИТЕТУ

Активізація інноваційної діяльності в Україні розглядається наразі як найважливіший чинник економічного зростання і технологічного оновлення виробництва у вітчизняній економіці, стратегічного напрямку розвитку економіки і країни в цілому.

У сучасному світі університети зазнають фундаментальну трансформацію як у внутрішньому та зовнішньому середовищі, так і з метою їх діяльності. Характер сучасних змін вимагає нового погляду на модель університету.

Сьогодні «екосистеми» відносяться до найбільш популярних об'єктів наукових досліджень. Теорія бізнес-екосистем може бути застосована і до моделювання розбудови конкурентоспроможного університету.