ATLAS (Adaptive Teaching and Learner-Oriented Application Software)

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I. INTRODUCTION (*HEADING 1*)

The concept of personalized learning is the idea that instead of the learning process being instructor- centric, it must be learner centric [4]. Being learner-centric gives personalization, which makes learning according to the user's knowledge, preferred learning style, and his basic knowledge regarding the subject. Personalized learning is an effective way to learn new concepts, giving students time to explore subjects that they are interested in, using ways that fit their learning style best for them [1]. A learning system that is based on the ability of the user is very effective because learning a concept or skill, has no defined path rather, it is a path created by the learner [2]. With this learners can understand and break down topics at their own pace without trying to follow a designed path that may or may not be suited to them. Because of the trend of technology continuing to have an impact in our everyday lives, the use of interactive learning systems can become a great tool for personalized learning. Researchers have made progress in creating personalized learning systems using object architecture and adaptive learning technology [5]. Research shows that powerful new teaching, learning, and advising tools can help advisors and educators to be more personalized in how they instruct and advise students [8].

Adaptive learning systems will adjust the level of instruction based on the current ability and preferences of the learner [3]. This helps to solve the problem of not being able to catch up to lessons and concepts by making sure that the user is working at his level. Adaptive learning systems can determine the subject that a learner is improving or failing and adjust its learning system based on his performance.

In one paper, Researchers have found that student achievement growth in mathematics and reading for students who utilized personalized learning, especially in comparison to other schools. This growth was evident especially for students with a lower starting skill, as their growth was exponentially larger than other participants for the three years of usage. [6]

Last 2012, researchers in Indonesia conducted an investigation to explore the views of students in the field of electrical engineering with regards to programming. The researchers were able to conclude that these students had trouble understanding the basic concept of programming, major roots for this problem were the lack of examples for application of the concepts taught in coding, furthermore, it was discovered that the engineering students in the investigatory project were able to learn the most in the laboratory setting. In conclusion. The researchers proposed to make a visualization tool to help teach programming in a practical manner [7].This method of learning is also prevalent in personalized learning, as it is a tool that adapts to the proficiency of the student, rather than a "one size fits all" classroom setting.

According to Brian Heese (2014): 'when you learn computer programming you learn how to check your work for details, how to apply logic and how to persist at a task. You also learn how to ask a good question, often in written form. Finally you learn how to collaborate because much programming today is accomplished in teams. These timeless skills and learning behaviors will endure far longer than any programming language [10]. As programming is not only a tool to learn how to interact with computers, but it also aids as a method of logic formation and development of critical thinking skills.

In this project, the researchers aim to combine both programming and personalized learning to be able to thoroughly explain a chosen programming language, capitalizing on both the versatility of teaching a programming language, and the adaptiveness of a well-executed personalized learning environment.

II. RELATED WORKS

A. A personalized learning content adaptation mechanism to meet diverse user needs in mobile learning environments

Because of the trend of mobile technology, learning materials are available to us with the touch of our fingers. Because of this personalized learning became increasingly important to compliment the use of devices. This paper proposed Personalized Learning Content Adaptation Mechanism (PLCAM) that uses clustering and decision trees approaches in order to manage a large number of the user's requests. This method will intelligently deliver a personalized learning experience. The research returned results that

indicate that the method is efficient and is beneficial to users. PLCAM efficiently managed a large number of user requests and effectively gave users learning content that are more suitable to their current level[11].

B. *Intelligent web-based learning system with personalized learning path guidance*

Personalized learning is an effective way to learn new concepts, giving students time to explore subjects that they are interested in, using ways that fit their learning style best for them. Because of the advantages of personalized learning researchers focused on creating systems with personalized learning mechanics to make the learning process efficient and interactive. However, a common mistake in creating these systems is the failure to consider the learner's ability compared to the level of difficulty that the learning system has. This will lead to cognitive overload and disorientation that will affect the learner's progress. Because of this, the paper assesses if genetic based learning which creates learning paths based on incorrect testing responses of an individual learner in a proficiency test will provide any advantage in his learning process. The paper concludes that personalized learning systems are better than freely browsing learning mode due to the learning path created for the user[1].

C. *Learner Model for Learning Object Based Personalized Learning Environments*

Despite personalized learning eliminating most limitations from conventional teaching, proper guidance is still required to be able to execute implementation properly. This paper by Galip Kaya and Arif Altun proposes that a learner model be developed in application of personalized e-learning environments. Information such as: Learner status, expectations, individual learning styles, their performance, and context attributes. Furthermore, the paper iterates that there are 5 personalization levels used in a personalized learning environment. Name-based, Self-described, segmented, cognitive, and Whole-person. These methods help in defining the user's individuality and classifying them furthermore as a single user. The researchers also found that IMS LIP and IEEE PAPI standards, despite their good initial starting points, may not be sufficient in satisfying all the requirements of such a system.[12]

The paper also recommends against the use of "beginner, intermediate, and expert" as a way of gauging student's performance, citing it as vague and limiting them to only one classification. The researchers further recommend using an ontology-based system. A system wherein the establishment of different categories and their separate categories will be used, factors such as personalization level and Information that would be gathered from the learners that were mentioned earlier are examples of what the researchers recommend be used in creating such an environment. [12]

III. METHODOLOGY

Researchers have devised to use Python, an object oriented programming language,and it's corresponding libraries to develop the personalized learning program. The application, called ATLAS (Adaptive Teaching and Learner-Oriented Application Software)

Furthermore, to keep in line that the program is satisfactory to the standards of its users, The researchers will be gauging the design of the program by utilizing the System Usability scale, a tool for measuring the usability of a specific program, device, or application.

Aside from the program development, the researchers will conduct testing of the programs usability using this System usability Scale with Senior High School students as the chosen demographic. These students will be ranging from beginners, intermediates, and the experienced in the field of both programming and Python in general. They will be asked to try the program and answer the SUS questionnaire, providing feedback both in design and the content of the software.

ATLAS

Derived from the word atlas, meaning a collection of maps; This software aims to guide the user through python programming, creating a "roadmap" of learning that adapts to both the prior skill of the student, and updates itself with regards to their current aptitude. Rather than enforcing lessons that could be either too easy or too difficult, ATLAS (Adaptive Teaching and Learner-Oriented Application Software) is designed to gauge what's "just right" for the user, whilst continuing to be both an interactive and fruitful experience for the learner. In light of this, the researchers propose to create a coding based personalized learning management and tutorial system for programming Introduction; it is a tool that will be able to provide learners with an adaptive learning environment that will introduce them to programming.

The researchers have chosen Python as it is a programming language that is very light on syntax, making it a go to program for beginners in coding. Furthermore, its simple syntax does not make it lacking as language; With its extensive set of libraries, in-built data structures, easy to access community support, and open source framework, making python one of the most versatile of all the modern programming languages.

The program itself will be implementing Tkinter, a library found inside python that will aid in creation of a graphical user interface, making the software much more interactive and user-friendly.

System Usability Scale

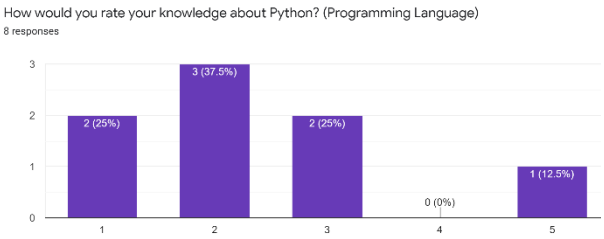
To actively incorporate personalized learning and an optimal environment for its learners, the researchers have

proposed to incorporate the system usability scale, a method of gauging the usability of the program.

Consisting of 10 questions with answers scaling from 1-5, The system is considered a “quick and dirty” method of gathering feedback regarding a programs’ usability. [13]

IV. Results and Discussion

The researchers were able to present the program to eight (8) students. Six (6) of these participants are in college, while one of them are in junior high school and the last one is in college



a.

Fig. 1. Question 1 about frequency

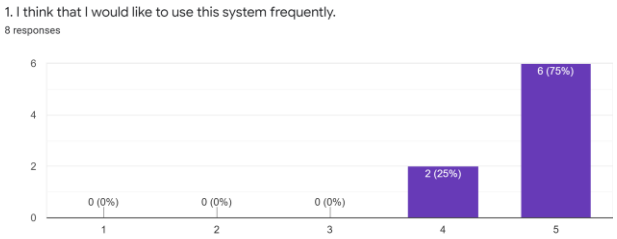


Fig. 2. Question about proficiency about coding in survey

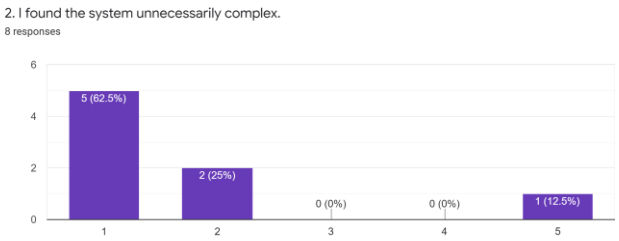


Fig. 3. Question 2 about complexity

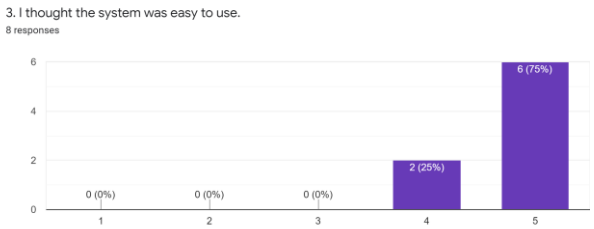


Fig. 4. Question 3 regarding system ease of access

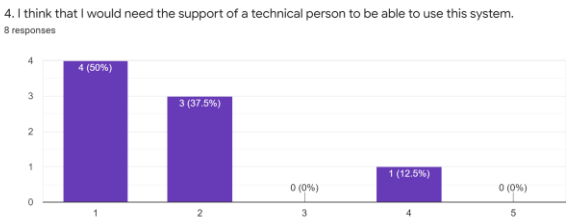


Fig. 5. Question 4 regarding technical support of someone else

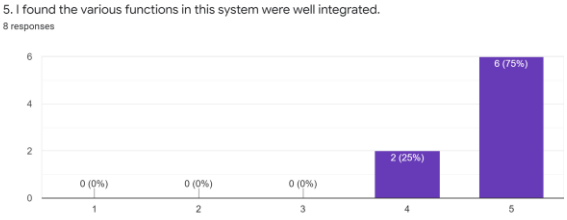


Fig. 6. Question 5 regarding v arious integration of functions

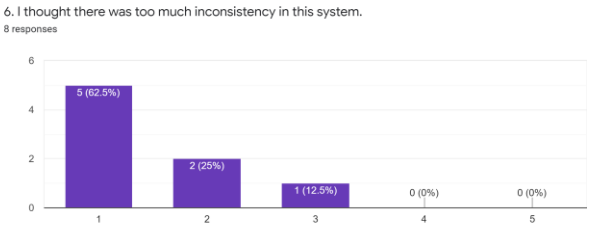


Fig. 7. Question 6 pertaining to the inconsistency of the system

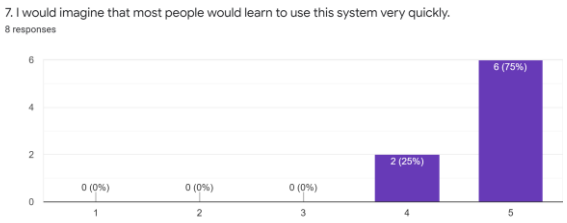


Fig. 8. Question about learning the application system easily

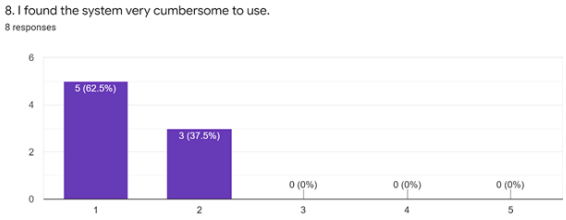


Fig. 9. Question regarding the program’s cumbersomeness

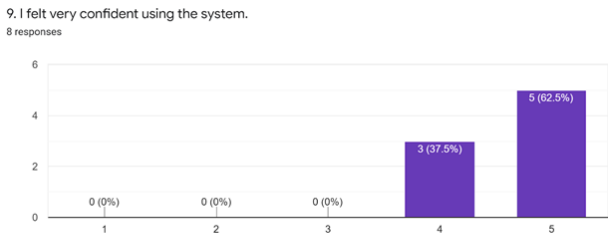


Fig. 10. Question about the confidence of users using the system

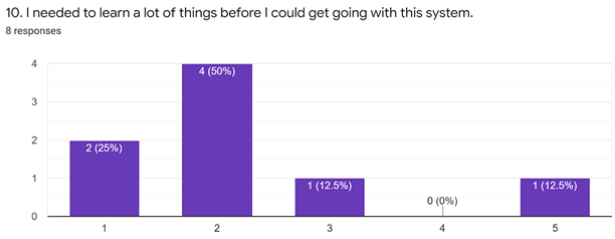


Fig. 11. Question about understanding the system

Of the 8 responses, 87.5 percent responded that they have little to medium knowledge in python language while one responded they have experience with python. This shows that the respondents have a diverse familiarity with python which is good to determine how effective it is for users with varying degrees of familiarity with the python language.

In the first question, 75% responded that they would like to use this program frequently while 2 or 25% responded with somewhat agree.

In the second question 87.5 % responded with disagree to somewhat disagree while one responded with strongly agree that the system is complex.

The third question showed that all of the respondents thought the system was easy to use.

The fourth question showed that 87.5 percent of respondents disagree to somewhat disagree in needing the support of technical person to use this system while one responded to agree.

The fifth question showed that all of the respondents agree to strongly agree that the various systems were well integrated.

The sixth question showed that 62.5% responded strongly disagree, 25% responded disagree and 12.5% responded neutral with the inconsistency of the system.

The seventh question showed that all of the respondents think that the system would be easy to learn.The eighth question shows that most respondents disagree with the system being cumbersome to use.

The ninth question showed that all of the respondents were very confident in using the system.

The tenth question was varied because it shows 25% strongly disagree,50% disagree,12.5% were neutral and 12.5% strongly agree with needing to learn a lot of things before starting with the system.In order to calculate SUS score subtract 1 from the user responses to odd statements, and subtract corresponding values from 5 in the even-numbered statements. By adding responses from all participants and multiplying the total by 2.5, you will have the final score. Using the formula the calculated system System usability scale score is 87.5 % which converts to A rating or excellent.

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	RAW	FINAL
5	5	5	1	5	1	5	1	5	1	36	90
4	1	5	1	5	1	4	1	4	2	36	90
5	1	5	2	4	1	5	1	5	5	34	85
5	1	4	2	5	3	4	2	4	3	31	77.5
5	1	5	1	5	1	5	1	5	1	40	100
5	1	5	4	5	1	5	1	5	2	36	90
5	2	4	2	4	2	5	2	4	2	32	80
4	2	5	1	5	2	5	2	5	2	35	87.5
										AVE:	87.5

Fig. 12. Computation of SUS score

V. **Analysis, Conclusion and Future Directives**

The results showed that ATLAS is an excellent tool in helping learners with varying degrees of knowledge about python , to start learning the programming language and to further develop and challenge their skills. The survey showed that the program was very easy to use which can benefit for the beginners that wish to learn python language without being too overwhelmed. it also states how tkinter functions were well integrated to ensure a productive learning. Adaptive learning with the level of the user was also very important to ensure that the user learns at his own pace and to challenge themselves by attempting more difficult levels. The survey also showed the things that our application lacks. One of the main criticisms is in the lack of design of the application. The application is very minimal which avoids being too overwhelming for the users but also is too plain and doesn't catch the attention of the user. Some. of the respondents also stated that the application was inconsistent and complex.

There are possible improvements and recommendations for this project in order to have a better learning experience. One of these is to add design to attract the user’s attention. The program lacks the use of color

elements from tkinter and is very minimal on the usage of frames.This also includes maximizing the space that the whole window can give, adding additional frames, scrollbar that can present easy access to modules or even the in-app IDE. Another one is the complexity and inconsistency of the program. For some beginners it might be difficult to start learning a programming language through an application without some guides. In order to make the experience more user friendly, implementing a starting guide after finishing the pre test would be effective. This starting guide would present all the relevant features of the application that will be helpful for the user to study python. The guide will aso show him how to unlock and utilize the modules and how to complete the program.

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REFERENCES

[1] Chen, C.-M. (2007). Intelligent web-based learning system with personalized learning path guidance. Science Direct, 51, 787–814. Retrieved from https://reader.elsevier.com/reader/sd/pii/S0360131507000978?token=D0F29CF61E5C0C698467F538A37ADA4A00A0861DCC9D50D8E58B6A711152122EB7B9D42663D9F3C51EBAA7B268D5435D

[2] UNESCO International Bureau of Education . (2017). Personalized Learning. Retrieved March 4, 2020, from https://unesdoc.unesco.org/ark:/48223/pf0000250057

[3] Oxman, S., & Wong, W. (2014, February). WHITE PAPER: ADAPTIVE LEARNING SYSTEMS. Retrieved March 4, 2020, from http://kenanaonline.com/files/0100/100321/DVx_Adaptive_Learning_White_Paper.pdf

[4] Xu, D., Huang, W. W., Wang, H., & Heales, J. (2014). Enhancing e-learning effectiveness using an intelligent agent-supported personalized virtual learning environment: An empirical investigation. Information & Management, 51(4), 430–440. doi: 10.1016/j.im.2014.02.009

[5] Zhang, Y. J. (n.d.). Important Design Considerations for Online Web Courses. Encyclopedia of Distance Learning, 1042–1047. doi: 10.4018/978-1-59140-555-9.ch152

[6] Pane, J. F., Steiner, E. D., Baird, M. D., & Hamilton, L. S. (2015). Continued Progress: Promising Evidence on Personalized Learning. Rand Corporation.

[7] Derus, S. R. M., & Ali, A. Z. M. (2012, September). Difficulties in learning programming: Views of students. In 1st International Conference on Current Issues in Education (ICCIE 2012) (pp. 74-79).

[8] B. Means and J. Roschelle, "Technology and Learning: Overview," in E. Baker, B. McGaw, and P. Peterson, eds., International Encyclopedia of Education, 3d ed. (Oxford: Elsevier, 2010

[9] Alli, N., Rajan, R., & Ratliff, G. (2016, March 7). How Personalized Learning Unlocks Student Success. Retrieved from https://er.educause.edu/articles/2016/3/how-personalized-learning-unlocks-student-success

[10] Heggart, K. (2014, June 17). Coded for Success: The Benefits of Learning to Program. Retrieved from https://www.edutopia.org/discussion/coded-success-benefits-learning-program

[11] Su, J.-M., Tseng, S.-S., Lin, H.-Y., & Chen, C.-H. (2011). A personalized learning content adaptation mechanism to meet diverse user needs in mobile learning environments. User Modeling and User-Adapted Interaction, 21(1-2), 5–49. doi: 10.1007/s11257-010-9094-0

[12] Kaya, G., & Altun, A. (2011, October). A learner model for learning object based personalized learning environments. In *Research Conference on Metadata and Semantic Research* (pp. 349-355). Springer, Berlin, Heidelberg.

[13] System Usability Scale (SUS). (2013, September 6). Retrieved from https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html

[14] Py, giovanni G. (2018, August 27). Tkinter - An example of an App. Retrieved from https://pythonprogramming.altervista.org/tkinter-an-example-of-an-app/

[15] r/learnpython - Interpreter/Command Prompt in tkinter. (2017). Retrieved March 2020, from https://www.reddit.com/r/learnpython/comments/4yewvc/interpretercommand_prompt_in_tkinter/

[16] r/learnpython - Interpreter/Command Prompt in tkinter. (2017). Retrieved March 2020, from https://www.reddit.com/r/learnpython/comments/4yewvc/interpretercommand_prompt_in_tkinter/

[17] Creating A Quiz Application Using Tkinter. (2019, February 26). Retrieved March 2020, from https://www.youtube.com/watch?v=ES8GDaBbgEI