JPPIPA 11(11) (2025)

Jurnal Penelitian Pendidikan IPA

http://jppipa.unram.ac.id/index.php/jppipa/index

Analysis of Learning Strategies of Students with Intellectual Disabilities Using E-LAPD-Based Liveworksheets in Chemical Compound Nomenclature

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Received: August 30, 2025
Revised: October 10, 2025
Accepted: November 25, 2025
Published: November 30, 2025

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DOI: 10.29303/jppipa.v11i11.12986

Abstract: This study aims to analyze the learning strategies of students with intellectual disabilities using E-LAPD-based Liveworksheets on the nomenclature of chemical compounds by applying the UDL (Universal Design for Learning) approach. The research method used is a mixed of quantitative and qualitative. Quantitative analysis uses validation results and pretest and posttest scores. Pretest and posttest data were analyzed using N-gain**.** Qualitative analysis uses the results of interviews with students with intellectual disabilities**,** which will be analyzed using the NVivo application. The results of this study indicate that the application of the UDL (Universal Design for Learning) approach to students with intellectual disabilities is practical to implement. This is evidenced by the results of student interviews analyzed using the NVivo application using Cluster Analysis, grouping codes or themes based on their similarities in the text, producing a similarity matrix. In addition, this is evidenced by the pretest and posttest data analyzed using N-gain scores showing a good category with an N-gain score of ≥ 0.7**.** Based on these findings, it can be concluded that the application of the UDL (Universal Design for Learning) approach with E-LAPD to students with intellectual disabilities on the nomenclature of chemical compounds is practical to implement.

Keywords: E-LAPD; Intellectual disabilities; Liveworksheets; Nvivo; UDL

Introduction

Education plays a vital role in human life. It enables generations to become role models for the generations that preceded them. Sudjana (2019) states that sustainable education is a never-ending process, continuously evolving, resulting in a consistent quality of education. Education is the most important thing for anyone, as education can shape a person into a strong character and provide a broad view of the future (Alika & Radia, 2021). Future education will impact this quality, creating a conducive learning environment and producing high-quality students. Education encompasses many areas that help students become high-quality learners, including chemistry.

Chemistry is a branch of science. Chemistry is one of the fields of science (Natural Science) found in phases E and F of the Merdeka curriculum, which studies the nature, composition of matter, material structure, changes, and energy that accompany material changes (Langitsari et al., 2021). Chemistry It is often considered a difficult subject due to the complex nature of the material presented. The complex concepts in chemistry consist of theories, complex calculations. Because chemistry is considered a complex subject, it is necessary to design learning strategies to help students understand chemical concepts.

How to Cite:
Kurniawan, M. R., Santoso, T., Sari, R. F., Muchlis, & Novita, D. (2025). Analysis of Learning Strategies of Students with Intellectual Disabilities Using E-LAPD-Based Liveworksheets in Chemical Compound Nomenclature. *Jurnal Penelitian Pendidikan IPA*, *11*(11), 1253–1264. https://doi.org/10.29303/jppipa.v11i11.12986

Learning strategies create an adequate and efficient learning process, with the aim of achieve basic competencies and provide a positive learning experience. According to Hayaturraiyan et al. (2022), each designed learning strategy has its advantages and objectives. Educators are expected to possess the knowledge and skills to select and implement the learning strategies they have developed. Furthermore, educators can also choose alternative learning strategies that, according to them, align with the formulated objectives. Educators have goals to achieve in the learning process to ensure that the designed learning strategy is efficient and effective. One of these goals is to improve students' learning outcomes.

According to Nuralan et al. (2022), learning outcomes are the accomplishment of educational objectives by students who participate in the learning process. The success of the learning process is generally seen from the learning outcomes achieved by students, the problem that is often encountered in the learning process is the low learning outcomes obtained by students (Rahmadhni & Chatri, 2023). Each student's behavior, attitude changes, and performance can all be connected to learning outcomes. Since learning outcomes affect students' comprehension of the material and their ability to master its concepts, they can also be related to conceptual knowledge. As a result, pupils find it more straightforward to comprehend and learn the material they are given. Students learning outcomes can give information about student's progress in achieving their learning activities (Laksana et al., 2021). Students will struggle to understand topics in the future, particularly chemistry subjects, if they do not grasp the concepts provided in the lesson (Nurhafizah et al., 2018). Student learning outcomes vary because they come from factors of the students themselves. Student learning outcomes, especially in chemistry subjects, are very diverse. There are several factors, such as interest or motivation to learn, the surrounding learning environment, or physical or psychological disorders of the students themselves. In addition, there is a condition of students, where the students experience obstacles in the learning process due to limitations in carrying out cognitive tasks, namely students with intellectual disabilities.

According to Khayati (2016), students with disabilities are children or students who have their own uniqueness or advantages in terms of type and characteristics, which differentiate them from other regular students. Intellectual disability is a developmental disorder characterized by an inability or limitation to perform tasks related to cognitive function, function, or problem-solving. This disorder is manifested by more than one of the following characteristics: slower learning rate, irregular learning patterns, difficulties with adaptive behavior, and difficulty understanding abstract concepts (Ni'matuzahroh et al., 2021). Students with intellectual disabilities are one of the disorders in the growth and development process, usually characterized by limitations in carrying out cognitive tasks, functions, or problem-solving. The characteristics of students with intellectual disabilities are usually marked by a slower learning rate, irregular learning patterns, difficulties with adaptive behavior, and difficulty understanding abstract concepts (Lubis et al., 2023). In contrast with a group of students with the same intellectual capacity, students with intellectual disabilities require more time since they have intellectual disabilities, as suggests Amelia (2016). The general condition seen is intellectual development that is not the same as or is delayed compared to their peers. Students with moderate intellectual disabilities still possess cognitive abilities that can be improved through education and training (Desriyani et al., 2019). Education and training provided to students with intellectual disabilities can help them understand concepts, particularly in chemistry. An appropriate strategy or education for students with disabilities, particularly those with intellectual disabilities, is the use of individualized educational strategies.

Teachers and educators can effectively utilize individualized education strategies for students with intellectual disabilities or those experiencing learning delays. Teachers and educators must consider the individual's condition and adapt the learning process to their needs. Students with intellectual disabilities in the learning process must be approached to receive the learning delivered by the teacher or instructor, so that they do not fall behind in understanding the material. The results of interviews with chemistry teachers at SMAN 10 Surabaya showed that students with intellectual disabilities attended lessons as usual with other students. However, they experienced intellectual obstacles that made slow-learning students lag behind others. The teacher stated that during the lesson, she only used the lecture learning model and did not use a specific approach for students with intellectual disabilities. Therefore, the appropriate approach for students with intellectual disabilities is the UDL approach. The UDL approach is a pedagogical framework that aims to create more inclusive learning by proactively planning for classroom diversity, including various backgrounds, abilities, and learning preferences (CAST, 2018).

According to Sukarmin et al. (2020), teachers can select and pay attention to the media used for students, especially students with intellectual disabilities. Learning media are packaged interestingly in the learning process, thus creating innovative learning

media. In chemistry learning, there are many ways for students, especially students with intellectual disabilities, to improve their learning outcomes in chemistry subjects by utilizing media that can be used in the learning process, including Liveworksheets. According to Widiyani et al. (2021), Liveworksheets is a web-based media platform that can create interactive worksheets electronically by utilizing video, images, and audio features. Liveworksheets can be used to create practical learning tools or media, including creating and using E-LAPD by utilizing its features. Liveworksheets is a worksheet provider platform that converts conventional worksheets into interactive worksheets by using technology (Fahrizy & Fathurrahman, 2024). E-LAPD for students with intellectual disabilities will be packaged or developed by displaying simple visuals, text, words, images, and videos for easy understanding. A Q&A session with a teacher at SMAN 10 Surabaya revealed that there were no learning media or tools specifically designed for students with intellectual disabilities. They use the same learning media and tools as regular students, but require assistance from a dedicated teacher to help them understand the material.

Based on the problems above, the researcher wants to conduct a study, "Analysis of Learning Strategies of Students with Intellectual Disabilities with E-LAPD-Based Liveworksheets on the Material of Chemical Compound Nomenclature," to analyze the effectiveness of learning methods used by students with intellectual disabilities to understand chemical concepts in the material on chemical compound nomenclature. To achieve this goal, live worksheets are used with the UDL approach.

Method

This research uses a mixed-method approach, which includes quantitative and qualitative analysis, and the model used is a concurrent embedded design. Quantitative analysis is used to validate the device that will be used for the trial, namely E-LAPD, which is validated from the content and construct. The validation data were analyzed using a quantitative descriptive methode in the form of a percentage obtained based on calculating assessment score criteria using the Likert scale which can be seen in Table 1.

Table 1. Likert Scale (Riduwan, 2008)

Value	Assesment
1	Very bad
2	Bad
3	Quite good
4	Good
5	Very good

Data from the pretest and posttest are used to evaluate the learning outcomes of students with intellectual disabilities. The pretest and posttest data for students with intellectual disabilities were analyzed using N-gain. The N-gain score is used to determine the increase in students' pretest and posttest scores; here is the N-gain score formula:

$$g = \frac{postest\ score - pretest\ score}{ideal\ score - pretest\ score} \quad (1)$$

The calculation results of the value (g) are interpreted according to the criteria in Table 2.

Table 2. N-Gain Score Criteria (Hake, 1998)

Value range	Category
$G \geq 0.7$	High
$0.3 \leq G < 0.7$	Medium
$G < 0.3$	Low

Qualitative analysis was used to analyze the results of the interviews with the application of the UDL approach applied during the learning process using E-LAPD developed for students with intellectual disabilities. The NVivo application was used to analyze interview transcripts. The results were analyzed to find out the analysis of the results of the interviews after using the application of individual education learning strategies using the UDL (Universal Design for Learning) approach, with the principles of UDL such as: 1) multiple means of engagement; 2) multiple means of representation; and 3) multiple means of action and expression. The following is the flow of this research:

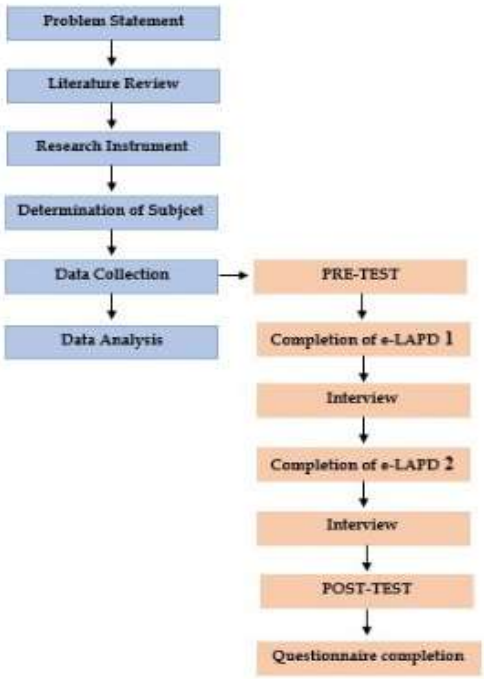


Figure 1. Concurrent embedded research flow

The data collection technique used in this study was interviews with students with intellectual disabilities, pretest, and posttest questions. The data collection implementation stage began with the provision of pretest questions before being given treatment to measure the ability of student learning outcomes. After being given the pretest questions, learning continued using individual education learning strategies using the UDL (Universal Design for Learning) approach, assisted by the presence of E-LAPD using Liveworksheets as a support. After the learning was completed, students were interviewed regarding their learning experience using the UDL approach, assisted by using E-LAPD on liveworksheets. After conducting the interview stage, students were given posttest questions after being given treatment to measure the ability of students learning outcomes. Tiur Mmalasasari et al. (2023) stated that the posttest measures student competencies, learning outcomes, and the effectiveness of the applied learning methods.

Results and Discussion

Results

The research entitled "Analysis of Learning Strategies of Students with Intellectual Disabilities with E-LAPD-Based Liveworksheets on the Material of Chemical Compound Nomenclature" aims to analyze the application of learning strategies of students with intellectual disabilities in understanding chemical concepts on the material of chemical compound nomenclature using liveworksheets. Before the developed E-LAPD can be tested, it must be validated by a validator. The validators consist of 1 Special Education Study Program Lecturer, FIP Unesa, 1 Chemistry Teacher of SMAN 10 Surabaya, and 1 Special Assistant Teacher of SMAN 10 Surabaya. The E-LAPD that the validator will validate includes content and construct validation. The validation results concluded that the developed E-LAPD was declared suitable for testing with a score of ≥3. According to Riduwan (2008), if the results of the validation of learning devices, one of which is E-LAPD, are declared suitable for testing, it gets a score of ≥3.

The next stage is a limited trial. A limited trial will be conducted after the validator has validated the E-LAPD. The limited trial of the E-LAPD was conducted at SMAN 10 Surabaya with students with intellectual disabilities as subjects. The number of subjects or samples used was 3 grade XI students or students with intellectual disabilities who had already received material on chemical compound nomenclature. Before the researcher conducted the E-LAPD trial, students were instructed to work on pretest questions first. According to Lida Melani et al. (2021), the purpose of holding a pretest before the learning process begins is to determine the extent to which students have mastered the material to be taught. The pretest questions in this study aimed to determine and measure initial understanding of the material on chemical compound nomenclature. The results of the pretest for students with intellectual disabilities on the material on chemical compound nomenclature are as follows:

Figure 2. Diagram of student pretest results on chemical compound nomenclature material

The pretest results indicate that the pretest scores of students with intellectual disabilities on the nomenclature of chemical compounds are still relatively low. This is because students still do not have an overview of the material to be presented. In addition, students have not been given a learning process treatment regarding the nomenclature of chemical compounds, so their pretest scores are relatively low.

Table 3. Table of Initial Competencies of Students

Name	Gender	Age	IQ	Description
AF	M	18	104	Emotional situations that affect performance and learning
DA	M	17	108	Specific learning difficulties
EL	F	18	87	Intellectual capacity is classified as below average

After completing the pretest questions, students will work on the E-LAPD found in Liveworksheets. Liveworksheets is a digital platform that can be used in the learning process. It contains features that help develop learning media and assist students in working on learning media, one of which is E-LAPD (Lisnuriyanih, 2021). The E-LAPD given to students, especially students with intellectual disabilities, is packaged more concisely than the E-LAPD for regular students. E-LAPD, developed for students with intellectual disabilities, is packaged more simply and in accordance with the initial conditions or profiles of

students with intellectual disabilities so that it can be adjusted to the abilities of these students. The initial competencies of subjects or students with intellectual disabilities are shown in table 3.

The developed E-LAPD will be adapted to the students' backgrounds, so that the E-LAPD developed with the UDL approach will be appropriate to the circumstances and conditions of the students. The E-LAPD given to students covers the nomenclature of chemical compounds, consisting of the nomenclature of ionic compounds and covalent compounds, using the UDL (Universal Design for Learning) learning strategy. After students complete the E-LAPD, they will be interviewed regarding their previous work. Then, students will complete a posttest. The purpose of the posttest questions is to determine the intellectual progress of students, which is also known as the level of mastery of the students' material (Melani et al., 2021). In this study, the purpose of completing the posttest was to determine and measure the extent of understanding of the material or concept after the learning material, namely the nomenclature of chemical compounds, was presented. Researchers conducted the posttest by asking the same questions as the pretest questions after learning. The posttest results for students with intellectual disabilities are as follows:

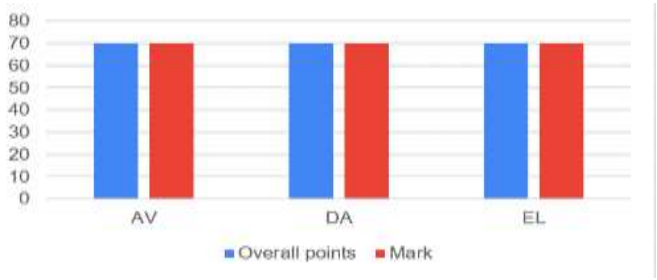


Figure 3. Diagram of student pretest results on chemical compound nomenclature material

Based on the posttest data, students with intellectual disabilities scored high on the chemical compound nomenclature topic. They already understand chemical compound nomenclature, resulting in a high posttest score. Furthermore, students have been exposed to the learning process, resulting in a high posttest score on the chemical compound nomenclature topic. Students will then complete a questionnaire based on the E-LAPD worksheet provided and the learning process implemented.

Discussions

Implementation of the UDL Approach to Students with Intellectual Disabilities

The learning strategy used in this study is individualized education with the Universal Design for Learning (UDL) approach. The UDL approach is highly appropriate for students with intellectual disabilities, as it is designed to help reduce learning barriers, enhance understanding of the material, and create an inclusive learning environment where all students, including those with intellectual disabilities, can collaborate and learn as a whole. The priciples of the UDL approach used in this study to improve the learning outcomes of students with intellectual disabilities is as follows:

Different Ways of Engagement

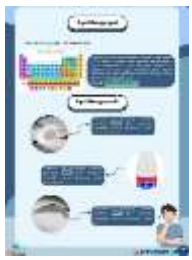
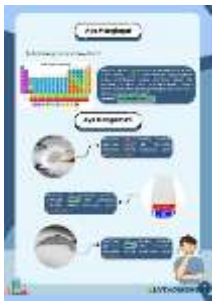
The first syntax of the Universal Design for Learning (UDL) approach is multiple ways of engagement. The engagement process offers various ways to foster interest and motivation in learning. In this section, students will be trained to recall previously presented material. Activities to recall previous material are provided to help them connect previous knowledge with new material, assess their readiness, and understand their prior knowledge. This will help them be prepared and easily understand the new material. In addition, students will be presented with phenomena or events in everyday life in order to foster interest and motivation in learning.

After carrying out the pretest activity, students will be trained to understand the material presented by recalling previous material in the E-LAPD provided. Remembering previous material trains students in understanding their knowledge by being given a question. The question leads to the previous material so the students can recall the previous material as an initial understanding. Next, students will be given a phenomenon or event in everyday life such as showing images or videos. Showing these images or videos can foster students' learning interest and motivation. The E-LAPD image generated from the implementation of UDL syntax 1 is shown in Table 4.

Students with intellectual disabilities were able to apply the first syntax of Universal Design for Learning (UDL), based on the E-LAPD work. This is shown by the fact that students were able to answer correctly according to the principle. The E-LAPD shows an image of the periodic table of elements. The image of the periodic table of elements shows a relationship to the material on the nomenclature of chemical compounds. Furthermore, the way the periodic table of elements image is presented shows that its intended purpose is to give a preliminary summary of the information on the names of chemical compounds, where the periodic table of elements will help students with intellectual disabilities name chemical compounds. Based on the results of the interviews performed with students with an intellectual disabilities, that the provision of this periodic table of elements helps in remembering and provides an overview that the nomenclature of chemical compounds is a combination of compounds from their

elements, so it is necessary to remember the periodic table of elements. In addition, in the principle 1 of UDL (Universal Design for Learning) there is a provision of motivation to students so that students can be motivated and interested in learning the nomenclature of chemical compounds. The motivation section presents images related to everyday life, such as sugar, salt, and vinegar. Interviews with students with intellectual disabilities revealed that providing images such as vinegar, sugar, and salt helps motivate them to learn chemical compound nomenclature. This demonstrates that salt, sugar, and vinegar have chemical compound names. Therefore, these images can motivate students.

Table 4. Results of E-LAPD Work on UDL Principle 1

Name	E-LAPD 1	E-LAPD 2
AV		
DA		
EL		

From the work on E-LAPD and interviews with students with intellectual disabilities, it shows that in the principle 1 UDL (Universal Design for Learning), namely "Multiple Ways of Engagement" shows similarities or connections as evidenced by the results of interviews, that in principle 1 UDL, students can remember previous material that has been delivered and foster learning motivation on the material nomenclature of chemical compounds. The data from interviews on principle 1 UDL will be analyzed using NVivo, namely using cluster analysis "Cluster Analys"— Cluster analysis in Nvivo is used to group codes or themes based on their similarities in the text, producing a similarity matrix from the results of student interviews. The analysis shows the connection of the interview results on E-LAPD 1 of the 3 students, showing the Pearson correlation coefficient value showing a range of 0.3-0.7. The table of Pearson correlation coefficient values from the interview results of E-LAPD 1 principle 1 is as follows:

Table 5. Pearson Correlation Coefficient Values for the Results of the E-LAPD 1 UDL Principle 1 Interview

Node A	Node B	Pearson correlation
Nodes//EL	Nodes//DA	0.707879
Nodes//DA	Nodes//AV	0.346878
Nodes//EL	Nodes//AV	0.338185

Based on the results of the correlation values of the three students in E-LAPD 1 principle 1 UDL showed results of 0.33; 0.34, 0.70. From the results of the correlation shows that EL students against DA students showed a correlation result of 0.707879. While in DA students with AV students showed a correlation value of 0.346878. The results of the correlation value between EL students and AV students showed a correlation value of 0.338185. From the results of the correlation values of the three students showed that there were different answer patterns from the interview results. However, from the different answer patterns of each student, the answers showed the answer results expected by the researcher. That in principle 1 UDL E-LAPD 1 showed that there was ease in implementing. In addition, students also emphasized in the results of their interviews that the apperception and motivation sections presented in E-LAPD enabled students to remember previous material, namely the periodic table of elements and pictures of sugar, salt, and vinegar, which motivated students to understand the material on chemical compound nomenclature.

The correlation between the interview results of E-LAPD 2 and the three students was 0.46-0.54. The table below shows the Pearson correlation coefficient values for the E-LAPD 2 and UDL principle 1 interviews:

Table 6. Pearson correlation coefficient values for the E-LAPD 2 and UDL Principle 1 interviews

Node A	Node B	Pearson correlation
Nodes//DA	Nodes//EL	0.545802
Nodes//DA	Nodes//AV	0.502912
Nodes//AV	Nodes//EL	0.4678

Based on the results of the correlation values of the three students in E-LAPD 2 principle 1 UDL showed

results of 0.46; 0.50, 0.54. From the results of the correlation, it shows that DA students against EL students showed a correlation result of 0.545802. While DA students with AV students showed a correlation value of 0.502912. The results of the correlation value between AV students and EL students showed a correlation value of 0.4678. From the results of the correlation values of the three students, it shows that there are different answer patterns from the interview results. However, from the different answer patterns of each student, the answers show the answer results expected by the researcher. That in principle 1 UDL E-LAPD 2 shows that there is ease in implementing. In addition, students also emphasized in the results of their interviews that the apperception and motivation sections presented in E-LAPD enabled students to remember previous material, namely the nomenclature of ionic compounds and pictures of sugar, salt, and vinegar, which motivated students to understand the material on the nomenclature of chemical compounds.

Different Ways of Representation

The second principle in the Universal Design for Learning (UDL) approach is various representation methods. The representation process aims to provide various methods or formats for presenting information in the form of material delivered so that students easily understand it. Presentation of material takes the form of providing brief explanations related to the material in the form of text, images, or videos that help students with intellectual disabilities understand the material presented. In this section, students will be provided with information or materials. By providing students with this material or presentation of information, they can understand the material presented and gain new insights.

In the E-LAPD given to students with intellectual disabilities using the UDL approach, in UDL principle 2, namely various representation methods, students will be given material on chemical compound nomenclature. The presentation of the material is in the form of images, videos on chemical compound nomenclature, or a summary of the material explaining the material on chemical compound nomenclature. After the material is provided, students will be given practice questions. The practice questions aim to allow students to find out whether students with intellectual disabilities can understand the material presented through the E-LAPD. The image results from the implementation of UDL principle 2 on the E-LAPD is shown in Table 7.

The E-LAPD implementation shows that students with intellectual disabilities can apply and understand the principle 2 of UDL (Universal Design for Learning). This is indicated by the students' ability to answer correctly in the principle. The E-LAPD explains the material on chemical compound nomenclature and practice questions within it. The presentation of the material used uses images, learning videos, and a summary of the material using a brief explanation. The goal is that students, especially students with intellectual disabilities, can understand the material presented through the syntax 2 of UDL using E-LAPD. In the practice questions activity, practice questions are given regarding naming chemical compounds. Students are asked to complete the compound's name to become the compound's actual name. Based on the results of interviews with students with intellectual disabilities, in this UDL principle 2, the summary of the material presented in E-LAPD helps understand the naming of chemical compounds. In addition to the presentation of the summary of the material, these students with intellectual disabilities stated that the practice questions provided in E-LAPD make it easier to understand the material on chemical compound nomenclature. According to his explanation, the presentation of questions in E-LAPD is easy to follow, so students can answer the questions correctly and understand the material on chemical compound nomenclature.

Table 7. Results of E-LAPD Implementation on UDL Principle 2

Name	E-LAPD 1	E-LAPD 2
AV		
DA		
EL		

From the work on E-LAPD and interviews with students with intellectual disabilities, it shows that in the principle 2 UDL (Universal Design for Learning), namely "Multiple Ways of Representation" shows similarities or connections as evidenced by the results of interviews, that in principle 2 UDL, there is a summary of the material and practice questions given with the aim that students with intellectual disabilities can understand the material on the nomenclature of chemical compounds. The data from interviews on principle 1 UDL will be analyzed using NVivo, namely using cluster analysis "Cluster Analys"— Cluster analysis in Nvivo is used to group codes or themes based on their similarities in the text, producing a similarity matrix from the results of student interviews. The analysis shows the connection of the interview results on E-LAPD 1 of the 3 students, showing the Pearson correlation coefficient value showing a range of 0.15-0.65. The table of Pearson correlation coefficient values from the interview results of E-LAPD 1 principle 2 is as follows:

Table 8. Pearson Correlation Coefficient Values for the Results of the E-LAPD 1 UDL Principle 2 Interviews

Node A	Node B	Pearson correlation
Nodes//DA	Nodes//EL	0.65702
Nodes//DA	Nodes//AV	0.256098
Nodes//AV	Nodes//EL	0.159516

Based on the results of the correlation values of the three students in E-LAPD 1 principle 2 UDL showed results of 0.15; 0.25, 0.65. From the results of the correlation shows that DA students against EL students showed a correlation result of 0.65702. While in DA students with AV students showed a correlation value of 0.256098. The results of the correlation value between AV students and EL students showed a correlation value of 0.159516. From the results of the correlation values of the three students showed that there were different answer patterns from the interview results. However, from the different answer patterns of each student, the answers showed the answer results expected by the researcher. That in principle 2 UDL E-LAPD 1 showed that there was ease in implementing. In addition, students also explained in the results of their interviews that the presentation of the material consisting of images, videos, and summaries of the material in the form of text on the nomenclature of chemical compounds, sub-material on the nomenclature of ionic compounds, made the students able to understand the material presented. In addition, the presentation of questions on E-LAPD showed strengthening of concepts related to understanding the material on the nomenclature of chemical compounds, sub-material on the nomenclature of ionic compounds, so that the students could understand the material presented.

The results of interviews with E-LAPD 2 UDL principle 2 students showed a range of 0.37-0.69. The table of Pearson coefficient correlation values is as follows:

Table 9. Pearson Correlation Coefficient Values for the Results of the E-LAPD 2 UDL Principle 2 Interviews

Node A	Node B	Pearson correlation
Nodes//EL	Nodes//DA	0.691667
Nodes//EL	Nodes//AV	0.580789
Nodes//DA	Nodes//AV	0.376956

Based on the results of the correlation values of the three students in E-LAPD 2, the 2 UDL principles showed results of 0.37; 0.58, 0.69. From the results of the correlation, it shows that EL students against DA students showed a correlation result of 0.691667. While EL students with AV students showed a correlation value of 0.580789. The results of the correlation value between DA students and AV students showed a correlation value of 0.376956. From the results of the correlation values of the three students, it shows that there are different answer patterns from the interview results. However, from the different answer patterns of each student, the answers show the answer results expected by the researcher. That in the 2 UDL principles of E-LAPD 2 shows that there is ease in implementing. In addition, students also explained in the results of their interviews that the presentation of the material consisting of images, videos, and summaries of the material in the form of text on the nomenclature of chemical compounds, sub-material on nomenclature of covalent compounds, made the students able to understand the material presented. In addition, the presentation of questions on E-LAPD showed strengthening of concepts related to understanding the material on the nomenclature of chemical compounds, sub-material on nomenclature of covalent compounds, so that the students could understand the material presented.

Different Ways of Action and Expression

The third principle in the Universal Design for Learning (UDL) approach is various modes of action and expression. This section aims to provide various ways for students, especially those with intellectual disabilities, to interact with the material and express their understanding. After students receive the material or presentation, they will be trained in their understanding by being able to conclude the material presented. This aims to strengthen the concepts and understanding of students after being given the material or practice questions.

In the E-LAPD given to students with intellectual disabilities using the UDL approach, in the 3 UDL syntax, namely various ways of action and expression, students will convey or provide conclusions about the material regarding the nomenclature of chemical compounds. Delivering conclusions in this learning shows whether students, especially students with intellectual disabilities, understand the material presented in the E-LAPD using the UDL approach. In the E-LAPD presented, students will provide conclusions related to the material presented by filling in the answer column related to summarizing the material presented. The image of the results of the implementation of the 3 UDL principle on the E-LAPD is as follows:

Table 10. Results of E-LAPD Implementation on UDL Principle 3

Name	E-LAPD 1	E-LAPD 2
AV		
DA		
EL		

From the E-LAPD work, it shows that students with intellectual disabilities can apply and understand principle 3 of UDL (Universal Design for Learning). This is shown by the fact that students can answer correctly according to the principle. In the E-LAPD, it is shown that students can provide conclusions related to the material presented in E-LAPD, namely the nomenclature of chemical compounds. Students in principle 3 of UDL are asked to provide conclusions related to the material given, namely the nomenclature of chemical compounds. The goal is for researchers to know whether students, especially students with intellectual disabilities, are able to understand the material presented through principle 3 of UDL using E-LAPD. This is in accordance with principle 3 of UDL, in which students reveal or express conceptual understanding of the nomenclature of chemical compounds by providing conclusions at the end of learning. Based on the results of interviews with students with intellectual disabilities, in this syntax of UDL 3, students can provide conclusions related to the material presented. According to student interviews, the use of E-LAPD, such as summaries of materials and practice questions, can help in providing conclusions, because the concepts it contains help students formulate conclusions.

From the work on E-LAPD and interviews with students with intellectual disabilities, it shows that in the principle 3 UDL (Universal Design for Learning), namely "Different Ways of Action and Expression" shows similarities or connections as evidenced by the results of interviews, that in principle 3 UDL, students can conclude the material presented, namely the nomenclature of chemical compounds. Summarizing the material aims to determine whether students, especially students with intellectual disabilities, can understand the material presented and the E-LAPD provided. The data from interviews on principle 3 UDL will be analyzed using NVivo, namely using cluster analysis "Cluster Analys"— Cluster analysis in Nvivo is used to group codes or themes based on their similarities in the text, producing a similarity matrix from the results of student interviews. The analysis shows the connection of the interview results on E-LAPD 1 of the 3 students, showing the Pearson correlation coefficient value showing a range of 0.28-0.59. The table of Pearson correlation coefficient values from the interview results of E-LAPD 1 principle 3 is as follows:

Table 11. Pearson Correlation Coefficient Values from the E-LAPD 1 Principle 3 UDL Interviews

Node A	Node B	Pearson correlation
Nodes//DA	Nodes//EL	0.59892
Nodes//DA	Nodes//AV	0.411995
Nodes//AV	Nodes//EL	0.281093

Based on the results of the correlation values of the three students in E-LAPD 1, the 3 UDL principles showed results of 0.28; 0.41; 0.59. From the results of the

correlation, it shows that DA students against EL students showed a correlation result of 0.59892. While DA students with AV students showed a correlation value of 0.411995. The results of the correlation value between AV students and EL students showed a correlation value of 0.281093. From the results of the correlation values of the three students, it shows that there are different answer patterns from the interview results. However, from the different answer patterns of each student, the answers show the answer results expected by the researcher. That in the 3 UDL principles of E-LAPD 1 shows that there is ease in implementing. In addition, students also explained in the results of their interviews, that these students can provide conclusions related to the material presented regarding the nomenclature of ionic compounds. In addition, providing the conclusion shows whether intellectual disabilities students can understand the material presented. Interview results with E-LAPD 2 principle 3 UDL students showed a range of 0.30-0.48. The Pearson correlation coefficient table is as follows:

Table 12. Pearson Correlation Coefficient Values from E-LAPD 2 Principle 3 UDL Interviews

Node A	Node B	Pearson correlation
Nodes//EL	Nodes//AV	0.482517
Nodes//EL	Nodes//DA	0.348927
Nodes//DA	Nodes//AV	0.301373

Based on the results of the correlation values of the three students in E-LAPD 2, the 3 UDL principles showed results of 0.30; 0.34; 0.48. From the results of the correlation, it shows that EL students against AV students showed a correlation result of 0.482517. While EL students with DA students showed a correlation value of 0.348927. The results of the correlation value between DA students and AV students showed a correlation value of 0.301373. From the results of the correlation values of the three students, it shows that there are different answer patterns from the interview results. However, from the different answer patterns of each student, the answers show the answer results expected by the researcher. That in the 3 UDL principles of E-LAPD 2 shows that there is ease in implementing. In addition, students also explained in the results of their interviews, that these students can provide conclusions related to the material presented regarding the nomenclature of covalent compounds. In addition, providing the conclusion shows whether intellectual disabilities students can understand the material presented.

Student Learning Outcomes to Students with Intellectual Disabilities

In this study, to measure the learning outcomes of intellectual disabilities students on chemical compound nomenclature, pretest and posttest data were used. The pretest was administered before students received any treatment during the learning process. In this study, the pretest was administered before students completed the E-LAPD. The posttest was administered after students received the treatment, namely the E-LAPD. The pretest and posttest data for intellectual disabilities students on chemical compound nomenclature are as follows:

Table 13. Pretest and Posttest Results of Intellectual Disabilities Students on Chemical Compound

Name	Overall value	Pretest	Postest
AV	70	10	70
DA	70	30	70
EL	70	0	70

In addition, the pretest and posttest results of the students were summarized using the N-gain score to determine the improvement in learning outcomes of intellectual disabilities. The following is the N-gain test data for intellectual disabilities:

Table 14. N-gain Score Results Related to Intellectual Disabilities Learning Outcomes

Name	Pretest Score	Postest Score	N-gain Score	Category
AV	10	70	1	High
DA	30	70	1	High
EL	0	70	1	High

Based on the results of the pretest posttest data analyzed using the N-gain score, the N-gain score was G ≥ 1. According to Hake (1998), it shows that the N-gain score shows a result of 1 or G ≥ 0.7 which is included in the high category. When associated between the N-gain score and student learning outcomes, according to Hake (1998), it shows that there is an increase in student learning outcomes. From this analysis, it shows that the application of the UDL (Universal Design for Learning) approach to intellectual disabilities students on the material of chemical compound nomenclature on the learning outcomes of intellectual disabilities students has increased as evidenced by the N-gain score of 1 or showing G ≥ 0.7.

Conclusion

This study shows that the analysis of learning strategies for intellectual disabilities students using E-LAPD-based liveworksheets on chemical compound nomenclature with the Universal Design for Learning (UDL) approach is practical and easy to implement. This

is demonstrated by interviews with intellectual disabilities students and the results of the pretest and posttest. This is evidenced by the coefficient values ranging from low to very high, namely 0.15-7 and the improvement in the pretest and posttest results analyzed using the N-gain score showed a result of 1 or $G \geq 0.7$ which indicates a high category result. This success is supported by the principles of UDL which include various modes of engagement, various modes of representation, and various modes of action and expression. Thus, the application of learning strategies with the UDL approach for intellectual disabilities students is practical and effective.

Acknowledgments

The author gratefully acknowledges SMAN 10 Surabaya for their kind cooperation in serving as the research site and for providing the necessary permissions, support, and guidance throughout the study. Profound appreciation is also extended to Universitas Negeri Surabaya, Faculty of Mathematics and Natural Science, Departement of Chemistry Education, as well as to all academic and administrative staff whose contributions and assistance were invaluable to the successful completion of this research.

Author Contributions

M.R.K. served as the primary author responsible for article writing, review, editing, as well as contributing to the conceptualization of the research idea; T.S. acted as the contributed yo project administration; R.F.S supervised the process of the research data collection; M.C. contributed to data validation and methodology; D.N. provided supervision and guidance in the development of research ideas and conceptualization. All authors have read and approved the published version of the manuscript.

Funding

This research was funded by the Directorate of Research, Technology, and Community Service (DRTPM), Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia. The APC was funded by DRTPM.

Conflicts of Interest

In writing this article, we sincerely declare that no conflict of interest may affect the objectivity and integrity of the results.

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