

Renewable Assignments in Open Pedagogy in Mathematics

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Abstract

Open Pedagogy engages students not just as passive recipients of knowledge rather creators of knowledge. Students in open pedagogy learn to adapt knowledge or create new knowledge and develop open educational resources that can be used by other learners. Assignments are used by many institutions as a technique of testing students on higher order learning. In Higher educational institutions, these assignments have a one-time value for evaluation and awarding grades. Renewable Assignments in Open pedagogy is a resource rather than a product that is used just for evaluation and grading. In Mathematics it is very significant to engage pupils in renewable assignments, as pupils can have a snowballing learning experience. Many institutions accept physical assignments and collect it for physical inspections and marking. These assignments of students have embedded creativity which would be a waste if not used effectively. Therefore, to make assignments sustainable, teachers must design good assignments and enable pupils to develop useful skills. This requires change in attitude and positive action. Students' attitude towards assignment and evaluation must change if we need this continuous flow of creativity in the teaching learning process. The paper emphasizes recycling of assignments for optimal use. The paper also mentions techniques of teaching which can make students as knowledge creators rather than recipients of knowledge. The paper advocates non disposable/renewable assignments for sustainability in evaluation.

Keywords: open pedagogy, sustainable assignments, renewable assignments, non disposable assignments, knowledge creation.

Introduction

“Knowledge consumption and knowledge creation are not separate but parallel processes, as knowledge is co-constructed, contextualized, cumulative, iterative, and recursive” (DeRosa & Jhangiani, 2017).

Open pedagogy according to David Wiley means that set of teaching and learning practices only possible in the context of unrestricted access and 4R permissions which are fundamental attributes of open educational resource. University of Texas, Arlington libraries posits that open pedagogy caters to other aspects but mainly engages students as the main creators of it rather than passive consumers of content. Open Pedagogy is totally grounded in the principles of ‘Experiential Learning’ wherein students demonstrate their creative capacities. Therefore, all educational products of open pedagogy are student-created and designed for the community at large. Ministry of Human Resource Development (MHRD) (2020) emphasizes personal accomplishment and intellectual enlightenment of students; enabling them to contribute to the society while developing robust solutions to their own problems. The UGC has

delineated the graduate attributes such as disciplinary knowledge, communication skills, critical thinking, problem solving, analytical reasoning, reflective thinking, digital literacy, among others. Renewable assignments are strategically directed to the graduate attributes. Tualaulelei & Pillay (2022), assert that renewable assignments facilitate the attainment of graduate attributes when conceptualized as an integral part of the learning process.

Hegarty (2015) identified the 8 attributes of open pedagogy. They are sharing ideas and resources, having a connected community, peer review, participatory technology, innovation and creativity, people with openness and trust and learner generated. DeRosa & Jhangiani (2017) characterize open pedagogy as access – oriented commitment to learning driven education. Assignments in open pedagogy are designed to be renewable and non-disposable in nature.

Clinton-Lisell & Gwozdz (2023) conducted a comparative analysis of traditional versus renewable assignments, across multiple variables: autonomy, relatedness, competence, inherent interest and enjoyment, and representational justice.



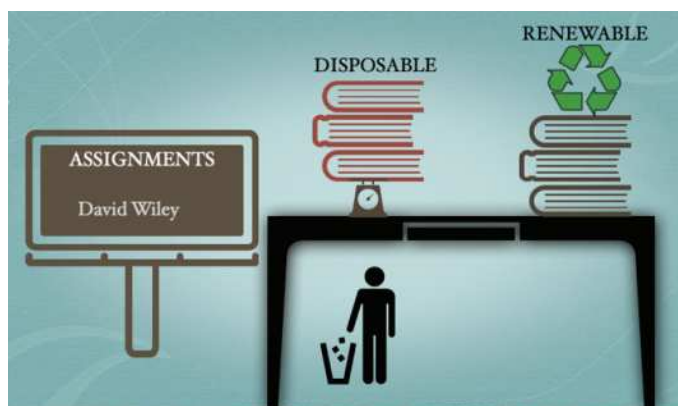


Figure 1: Difference between disposable and renewable assignments

Their findings reveal that renewable assignments were much superior than traditional assignments in terms of the variables in consideration. According to David Wiley assignments are disposable or renewable. Disposable assignments do not have a limited utility or in short, they have a one-time use. All assignments are designed to evaluate the attainment of learning outcomes. If assignments are designed with limited use, then they fall in the category of disposable assignments. Majority of the assignments fall under the category of disposable assignments, as teachers assess them and then return it back or stack it in the cupboards assigned for them where they collect dust and deteriorate physically over time. After several years these assignments are mostly disposed of. Renewable assignments are the assignments given to the students, but they have a different approach. Renewable assignments follow a different paradigm. They may be originally developed by the students, and some cases, may involve remixing or adapting existing OER (Wiley & Hilton III, 2018). These assignments are designed in such a way that their use does not end after their evaluation but potentially evolve into new projects or serve as valuable resources to new comers. Renewable Assignment Spectrum (<https://assets.pubpub.org/77q5sgzp/21683312091146.png>) can be a good reference to check the extent of renewability of the assignment created by Amanda Grey for KPU teaching and learning.

Some of the characteristics of renewable assignments are the following: students must be considered as architects and producers of knowledge, there is no loss of value of the assignment once its graded or submitted, it will lead to knowledge expansion, they incorporate high critical thinking activities,

collaboration, creativity ultimately enriching the student in a wholistic manner. These assignments are conceptualized to generate resources with applicability across diverse contexts and must be imbued with lasting utility beyond its initial submission. All renewable assignments function as open resources which must be accessible to all stakeholders thus serving the community at large and evolving through collective input and iterative revision. Renewable assignments are also called Non disposable assignments, these assignments provide substantial benefits to the learning community. Such assignments have a lasting cognitive impression, due to high intellectual engagement by the students as they use diverse intellectual competencies as a part of the assignment. The students thus display their abilities through the assignment that transcends classroom instruction. Thus, it could form a part of the student portfolio where they can showcase their talents and competencies. Renewable assignments can ensure high pupil engagement and interaction. Renewable assignments can invite extensive collaboration and consistent reference work which students would be bound to undertake as a part of their assignments.

Renewable assignments are learner-driven undertakings meticulously crafted to generate enduring value, foster dynamic collaboration, and contribute vital resources that others in the academic sphere can freely access and enhance. This is in stark contrast to the transitory nature of disposable assignments, with no utility after evaluation. The philosophy of open pedagogy fervently advocates for these renewable assignments, placing a premium emphasis on student empowerment, authentic knowledge creation, profound community engagement, and uninhibited open sharing, all woven together through the framework of experiential learning. Here are some examples of the type of renewable assignments.



Figure 2: Collaborative projects

Types of assignments

Specialized skill development assignments

Assignments which include learning of specialized skills for eg: Assignments which have to be developed using AI. In Mathematics AI plays a crucial role. AI can be used by students to create imaginative projects, with correct prompts. Prompt engineering will direct them to get their imagination on paper. For eg: A 3 -D figure consisting of 10 faces, all pentagons can be created by AI.

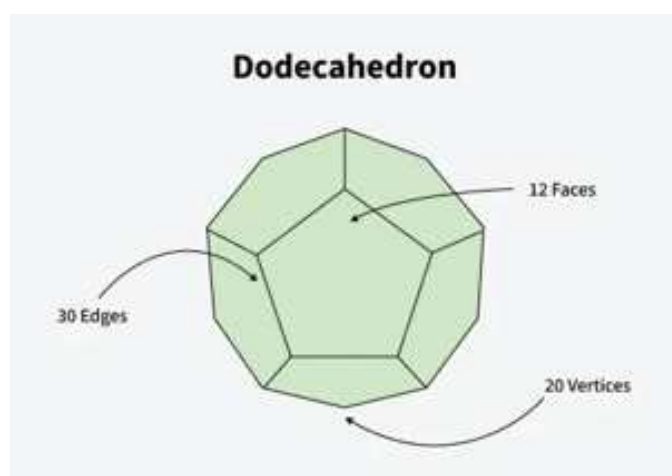


Figure 3: Dodecahedron

In this assignment the students have created a product but learnt how to use AI and how to develop prompts. Thus this assignment is a sustainable one and can be posted as an open educational resource

for other students.

Research oriented assignments

Assignments which require research for eg: A problem statement is given to the students and they are asked to develop a research design to solve the same. Eg: A study to understand Bank Transactions. The students can prepare a research design along with the teacher as their facilitator. The students can research on the topic and develop knowledge and skills on the topic 'Bank Transactions'.

Evaluative ability building assignments

Assignments which develop evaluative ability: there are number of processes within the institution which require evaluation, for eg: curricular practices, evaluation procedures, programs and events, policy analysis. Students can be given a theorem to analyze and evaluate. They could formulate different ways to prove the same theorem. This could be a new knowledge.

Metacognitive development assignments

Assignments that involve development of metacognitive ability, assignments that encourage reflection and self-analysis. Reflection on what are the errors committed by the child and why the errors are committed could be a self-reflective exercise. Design thinking skills could be applicable here for the assignment.

Innovation-Focused assignments

Assignments which include developing innovative ideas: eg: innovative teaching skill, entrepreneurship. Teachers can design assignments which can make students develop new models in the theory that they are taught. This will ascertain that students are not mere consumers of new knowledge but creators also.

Collaborative Problem-solving assignments

Assignment which requires collaborative ideas eg: work out solutions to environmental problems or entrepreneurship ideas. Students can develop skills of collaboration and team building by working on one assignment. Problem solving requires several steps and putting together several minds can lead to a creative solutions.

Wiley & Hilton III (2018) examined four types of assignments - Traditional, Authentic, Constructive and Renewable, as shown in the figure below (adapted by the author for Mathematics learning) :

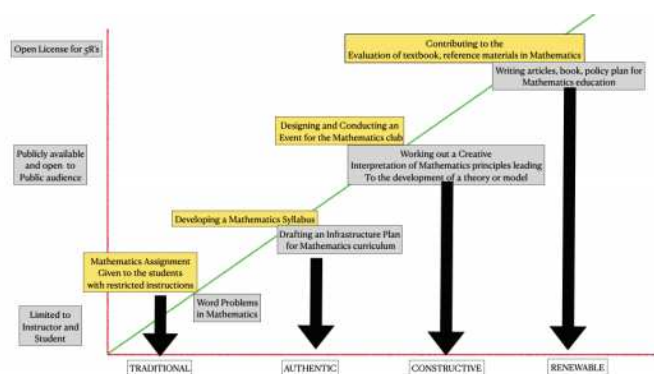


Figure 4: Types of assignments (Wiley & Hilton III, 2018).

Renewable assignments can aptly be termed as renewable or sustainable if the student has substantially grown in knowledge, skills and attitude. These assignments are not discarded but are disseminated for wider use as open educational resource with a creative commons license, which allows anyone unlimited use or adaptation. Assignments can create a chain of ideas which could catalyze a larger innovation. Assignments could culminate into creation of entrepreneurship projects that could lead to self-reliance and social transformation. Students must be provided a rubric through which they understand themselves and their work. Renewable assignments are also known as sustainable assignments. Sustainability means able to continue over a period of time. As mentioned before, assignments must not lose its value after evaluation, a student must continue referring to the assignments for its greater value. Lazzara, et al. (2023) and others worked on comparing the student and faculty perceptions related to renewable assignments. Students found renewable assignments more valuable in terms of value, interest, motivation and reward. Faculty reported that it enhanced their motivation and teamwork skills.

Institutions must allow students to endorse their assignments with the 5R permission (Reuse, Revise, Retain, Remix and Redistribute) of open educational resource and assign a creative commons license for wider circulation. This will equip students with knowledge creation skills. Students will realize that new knowledge needs to be created out of their own experiences and research, rather than be consumed.

Steps of a good assignment as an open educational resource

Identify the need for the assignment /s

Most teachers just give the assignment to the students, which leads to work which cannot be used or applied. Therefore, a pre discussion on various contexts is required to generate topics that could help in better understanding or leading to creative solutions.

Provide the options to the students to select the assignment according to their own interest

Freedom in Education is most important. Giving small freedoms can enhance the student participation and increase the joy of learning. So, providing various options to the students can help students choose according to their knowledge and skills.

Work out a blue print to proceed with the assignment

An initial hand holding for the assignment helps in visualizing the roadmap for the assignment. The blue print could be made in collaboration with the teacher.

Validate the blue print

The blue print can be validated with a co teacher or collectively with some valid criteria. Validation is required as students can follow some guidelines for the assignment. Validation can also ascertain the scientific process.

Guide them intermittently to strive for the more

The teacher adopts the role of a facilitator. Students can create new knowledge if they are motivated to do so. The new knowledge created must be in line with the principles of the discipline.

Validate the assignment and check for plagiarism

Plagiarism can affect the authenticity of the content. Originality must be encouraged.

Assign the creative commons license and upload on the online platform

Students must be trained to submit their work to the larger society through creative commons license. This will lead to the wider circulation of assignments, improvisation from other resource experts.

Outcomes of renewable assignments

Learners will be able to ...

Create new knowledge, Analyze data and draw inferences, Formulate new models / new theories, Work out different solutions to problems, Develop writing skills, Present nonverbal data in visual form, Collaborate with peers and experts for clarification and validation of concepts. These outcomes must have planned activities within the assignments so that the students experience these outcomes at the end of their assignment.

Role of teachers in developing Renewable assignments

Teachers must be mindful to different kind of learners in the class, they must design interesting and useful assignments according to the trends in teaching-learning, be resourceful and guide effectively, be well versed with developing open educational resources. Teachers must be thoroughly trained in open educational resources in order to promote developing such resources and transferring the knowledge of importance of these resources in the teaching-learning process. Renewable/Sustainable assignments will develop the culture of knowledge creation in educational institutions. This will lead to a positive change in the teacher – student relationship. Students have to develop the hunger for knowledge, rather than just amalgamating large amount of matter from disparate sources and presenting it as an assignment. Most of the assignments given by the teacher are direct and students guess quickly what they are supposed to do. This will hamper the imagination and creativity of the students. Teachers also become passive recipients of the information rather than receiving a creative treatise. Evaluation also becomes a monotonous activity, rather than an exercise of intellectual curiosity and originality. The danger is that such assignments would result in skewed performance of the students. Disposable assignments stifle the true abilities of the students and prevents meaningful differential assessment.



Figure 5 : Example of renewable assignment

Open Pedagogy involves students as co-creators of knowledge by using OERs. Therefore, in Open Pedagogy, development of Open Educational Resources by students is an important feature. Thus, Open Pedagogy is a student-led approach which negates consumption and directs students to a more integrated and collaborative approach to teaching learning. This, as Open Pedagogy experts say will build a knowledge society. Learning becomes more productive, creative and meaningful. Assignments are submitted year after year, semester after semester and subjected to monotonous evaluation procedures. Academic recycling practices, for the sole objective of creating new knowledge and sustainable practices will promote creation of innovative models, research projects and sustainable teaching practices.

The first step in designing assignments is to make students look beyond their textbooks. For eg: for the mathematics topic of ‘Profit and Loss’ the teacher asks the students to analyze the real-life transactions of a shopkeeper, and find out the profit he gains in a day, then the student will learn profit and loss, gaining mathematical proficiency as well as business skills. The findings of the assignment can then be presented to the whole class for further investigation. The topic on Mensuration can be taken to the real-life situations, where they examine visual representations. Students could be taken to different schools, where they could meet the students

studying in their own standard, and can be motivated to develop joint projects. This will bring in the greater value of collaboration in knowledge building forging meaningful connections between theory and practice. Assignment in Equations could be used to create puzzles by students using the unknown.

Art integrated approach can be used in assignments where the teacher could ask students to convert word problems to a pictorial form, which will help in better visualization of the problem. An experience of the 3D vessels at home and the measurement of volume, an experience of area of a sandpaper, can help students discover the application of these concepts in daily lives as well as understand the difference between the concept of area and volume. Experts in the subject can be invited to the school to speak on the latest developments in a topic which could trigger the need to develop small write ups or handouts on the application of the topic. This would help in greater learning and application of concepts in real life situation. Students must realize that the walls of the classroom are not limiting boundaries for learning. Teachers must collaborate with other institutions and design practical assignments for the service of the community at large thus expanding students' horizons of learning. Students have a variety of experience and they observe and analyze different problems that are existing in society. The solution to these problems is not far away but in the hands of the young minds. It is important to understand their perspective while designing the assignments. These assignments can then be open to all with a creative commons license.

Teachers must not impose on the minds of the learners, their own knowledge and feelings, but try to draw out the learners' understanding and thinking. Teachers must insist on the original work right from the school. In addition to this, Mathematics is considered as a dry subject, full of rules and by nature a monotonous subject, having one right answer. This will affect the interest of the child in the long run. Thus, teachers can motivate students to create songs, poems and art work as assignments related to the topic that they are studying. This will unleash their creativity and give them a break from the long-drawn-out step wise problems that they have to solve daily for their practice. The recreational activities will add to the body of creative knowledge and innovation. This will also make Mathematics more tenable and

more likeable among students and change the current status of Mathematics. Renewable assignments can cultivate an environment of autonomy and develop skillful learners, who are able to create knowledge.

In conclusion, the outcomes of learning must be learners who are well informed, trained in different skills, learn to apply their knowledge, and discontinue relying on textbook information. Students need to be more involved and engaged in learning and teachers must be excited about the assignments they give to the students. Adopting Open pedagogy will bring back the rigor as well as the joy of learning to the mathematics class, where students will realize that they are no longer recipients of knowledge but also creators of knowledge. Assignments will no longer be a boring task and will not be discarded, but will be considered as student resources. Assignments can be a part of student portfolios to showcase their work and innovative ideas. This could be a trigger for other students who could think further on the idea. Thus, assignments can be labelled as sustainable for the purpose of the greater learning that it is intended for. By adopting renewable assignments within an open pedagogy framework, education is revitalized with a participative learner community with greater metacognitive and innovative abilities. Renewable assignments can be successful if they invoke high engagement of students, and serve as catalyst for change and higher thinking. They can prove as an impactful teaching learning technique if prepared wisely and directed to the needs of the students. Learners can thus have a transformative experience thus leading towards individual and collective growth.

Author Notes

This paper was reviewed, edited, and refined with the assistance of Perplexity AI, complementing the human editorial process. The author critically evaluated the content for accuracy, flow and biases. Figs. 1 and 3 are created by the author, Figs.2 and 4 are created by Perplexity AI with prompts given by the author. The final version of the paper is the sole responsibility of the author.

Ethics and Consent

Author has followed ethical practices while writing this paper.



Acknowledgements

The paper has been inspired by the works and feedback of B.Ed. students of St. Xavier's Institute of Education (Autonomous), Mathematics Pedagogy groups.

Competing Interests

The authors have no competing interests to declare.

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