Chapter 8
The Pedagogical Perspective of Learning Analytics

8.1 Introduction to Pedagogy

8.1.1 What Is Pedagogy?

People often speak about their 'pedagogical approach' to teaching. But what does it mean? Pedagogy is clearly defined as the method and practice of teaching. It includes (TES, 2018):

- Teaching styles
- Teaching Theory
- Feedback and assessment

When people speak of the teaching pedagogy, they refer to how teachers convey the curriculum material to a class. When a teacher prepares a lesson, they consider multiple ways of presenting the material. This decision is taken based on their teaching interests, knowledge, and the context they teach.

Differences in the age of pupils and the content of pupils will affect the teacher's pedagogical practices. Teachers will use studies from several different academic backgrounds to inform their decisions and educate these age groups by their experience. For example, an EYFS instructor may refer to cognitive development studies and adult-directed play's performance. The choices will be the pedagogical principles, and every teacher will, over time, establish his pedagogical principles.

S. K G, M. Kurni, *A Beginner's Guide to Learning Analytics*, Advances in Analytics for Learning and Teaching,
https://doi.org/10.1007/978-3-030-70258-8_8

8.1.2 Importance of Pedagogy in Teaching

Using successful pedagogical methods, students can obtain learning outcomes and their maximum intellectual potential. Quality education offers a good base for learning. It helps students develop advanced concepts and skills. The correct pedagogy helps teachers to observe their students' academic success. The following points stress the importance of pedagogy (Yadav, 2020).

1. A carefully designed pedagogy increases teaching consistency. It makes the student more open to learning. This increases the involvement of the student in the teaching-learning process.
2. A suitable pedagogy helps educate students with various styles/skills. Students gain a deeper knowledge of the subject. This, in turn, means that the learning objectives of a curriculum are achieved.
3. A correct pedagogical approach is needed for students with special needs, students from disadvantaged groups, viz. females, or minorities. They are invited to be part of the mainstream learning culture.
4. A well-developed pedagogy encourages students to achieve higher cognitive abilities, i.e., analysis, synthesis, and evaluations. Knowledge, comprehension, and application are cognitive abilities of the lower order in Bloom's taxonomy.

8.1.3 Factors Affecting Pedagogy

Different factors impact pedagogy (Fig. 8.1) in a phase of teaching. Some obvious factors are subject, curriculum, learning motivation, and instructor's skills. Student learning patterns and facilities availability also affect pedagogy. Some of these considerations are discussed in the following points (Yadav, 2020).

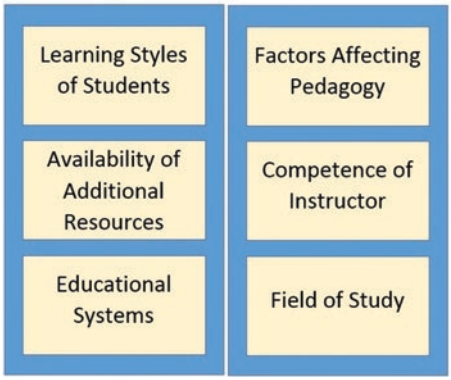

Fig. 8.1 Factors affecting pedagogy (Yadav, 2020)

1. ***Teacher competence:*** a professional teacher motivates students, keeps them interested and willing to learn. Such a teacher uses a wise mix of abilities, skills, and experience.
2. ***The student's learning styles:*** an awareness of students' learning styles allows teachers to follow a pedagogical approach. A pedagogical approach that complements student styles helps to speed up the learning process. It motivates and keeps students engaged in learning.
3. ***Field of Study:*** The field of study also affects pedagogical options. For example, physics needs a theory and laboratory balance. Political science does not require laboratory sessions. In addition to theory and laboratory sessions, the architecture includes field visits.
4. ***Additional tools availability:*** projectors, virtual labs, etc., contribute to broadening the reach of the teaching-learning process. Such educational opportunities keep learning and students alive.
5. ***Education System:*** education system regulations, curriculum requirements, etc. often impact the pedagogical approach. For example, a test that tests a student's ability to remember facts discourages the teacher from applying a pedagogy that improves superior thought.

8.1.4 Pedagogical Approaches

8.1.4.1 What Is the Pedagogical Approach?

1. The broad principles and methods used in teaching. Goodyear (2005) suggests that the pedagogical approach can be divided into Pedagogical Philosophy (describes the beliefs about how people learn) and a High-Level Pedagogy (to explain a broad approach between philosophy and action).
2. The educator agrees to promote contact between learning, dedication, teacher-student, student-student, or student-content (Brown & Eaton, 2020).

8.1.4.2 Types of Pedagogical Approaches

Successful pedagogical approaches are important to the efficient delivery of knowledge to students. The choice of a particular pedagogy depends on several factors. Pedagogy relates to each other teachers, students, and learning. It leads to academic success. Educationists often encourage teachers to develop their pedagogical approach. Some pedagogical methods (Yadav, 2020) are more common and omnipresent.

1. ***Constructivist approach:*** The student is the center of the learning process. Based on their present and previous experience, the student generates new ideas and concepts. The mentor promotes the process simply through the creation of

activities. Students find out and learn by troubleshooting. Learning might take place at a slower pace because of restricted discussions between the student and the teacher.

2. ***Reflective approach:*** Teachers periodically track their teaching pedagogy under the reflective approach. You track and monitor the suitability of your pedagogy in an educational setup. This method is more appropriate for trainee teachers as a model approach.
3. ***Collaborative approach:*** Students are expected to work together in small teams in the collaborative approach. Students may have various skill levels. The reason is that separated students do not learn as well as students in a squad. This small team can also include an instructor and a researcher in a research-oriented setup.
4. ***Integrative approach:*** The integrative approach concerns real-world classroom education. The students, therefore, find the teaching in the classroom more interesting and important. The students study a subject to enhance their skills. This method generates students' interest in mathematics and science.
5. ***Inquiry-based approach:*** This approach places the student at the center. To find a solution, students ask questions, use logic and problem-solving skills. The method focused on inquiries can be of four types: confirmation, structured, guided, and open.

8.1.4.3 Additional Pedagogical Approaches

There are other ways to identify pedagogical approaches (LearningPortal, 2018):

- ***Teacher-centered pedagogy:*** This pedagogy puts the teacher at the forefront of the learning process and generally relies on techniques such as whole-class lectures, rote memorization, and chorus responses (i.e., call and answer). This method is also criticized, in particular, if students only do lower-class tasks and are fearful about the teacher. However, classroom teaching may be successful if teachers ask students to elaborate on key ideas and not just lectures.
- ***Learner-Center Pedagogy:*** This pedagogic approach includes many related concepts (e.g., constructivist, student-centered, participatory, active) but typically use learning theories to imply that learners should be an active part of the learning process. Therefore, students use previous knowledge and new experiences to construct knowledge. The instructor supports this process but also establishes and structure the learning conditions. Significant studies and funding have supported learner-centered pedagogy for economic, cognitive, and political reasons in recent years. Some research indicates that this method can be very effective, but it is also difficult to calculate reliably. Teachers often find it difficult to move from pedagogy focused on teachers to educational pedagogy, and so significant help might be required if this is an essential goal for a given education system.
- ***Learning-centered pedagogy:*** Learning-centered pedagogy is a relatively recent term that recognizes pedagogy that is both learner-centered and teacher-centered, but teachers have to consider local circumstances, including the number of

students in the classroom, the physical environment, the availability of teaching and learning materials, etc. It recommends that teachers be versatile and adjust their pedagogical methods carefully, depending on the school setting.

8.1.5 Standards of Effective Pedagogy

Do you have these five principles of teaching? Take a deep dive with this self-check, originally made by the Center for Research on Education, Diversity, and Excellence at the University of California (Teaching Tolerance, 2020).

1. ***Joint Productive Activity:*** Teachers and Students Producing Together. Learning occurs most easily when experts and novices work together to accomplish a shared product or purpose and are inspired to support one another. The general concept of teaching is "assisting"; hence, joint productive activity (JPA) optimizes teaching and learning. Working together facilitates dialogue in immediate problems, which teaches vocabulary, meaning, and values. Learning through "joint productive activity" is intercultural, characteristic of human, and potentially "hard-wired." Parents with very young children, pre-schools, graduate schools, adult learning, work-related and service-learning, on-the-job training — in all schooling, aside from the tradition in K-12 — are distinguished by this form of "mentoring" and "learning" in action.
   There is generally little joint activity in schools, which creates common interactions and, therefore, no common meaning, encouraging students and teachers to establish common understanding structures. Joint interaction between teachers and students helps to establish a shared background in the classroom. This is particularly important if the teacher and the students do not have the same history.
   Joint activity and disclosure permit the highest degree of academic achievement to solve real-world issues using formal, "schooled," or "scientific" ideas. The continuous link between scholarly concepts and daily concepts is central to how mature scholarly thinkers comprehend the world. Both students and teachers should share these collaborative practices. Only when the instructor shares the interactions will the form of conversation arise that creates basic skills.
   Joint Productive Activity Indicators. The Teacher:

   (a) Designs instructional activities involving cooperation between students to achieve a joint product.
   (b) The time required to satisfy them meets the demands of the shared productive operation.
   (c) Arrange classroom seating for individual and community students to interact and work together.
   (d) Participates in joint constructive practice with students.

(e) Organizes students through different communities to facilitate engagement, such as friendship, mixed academic abilities, language, project, or interests.
(f) plans to operate in groups of students and switch from one task to another, for example, from large groups to small groups for cleanup, dismissal, and similar.
(g) Manages access to materials and technologies for students and teachers to promote collaborative, productive practices.
(h) Monitors and encourages effective student cooperation.

2. ***Language Development:*** Developing Language Across the Curriculum. Developing skills in instructional languages should be a meta goal of all educational activities during the school day. If teaching is bilanguage or monolingual, literacy is the key to school success. School awareness is inseparable from language and thought. Everyday social language, formal academic language, and subject lexicons are crucial to the success of education. Language acquisition at all levels — informal, problem-solving, and academic — must be facilitated not by exercises and decontextualized guidelines but by use and intentional interactions between teachers and students. Lecture and writing should be taught in particular curricula as well as incorporated into each field of material.
How language is used in a school debate, such as questions and responses, obstacles, and representations, is often foreign to English learners and other students at risk of education failure. However, their own culture can be effectively connected by building learning contexts that evoke and build on language strengths for children in academic disciplines.
Language production and literacy as meta goals also include the special language genres required to learn science, mathematics, history, art, and literature. Successful mathematical training is focused on the capacity to "speak mathematics," as well as on the mastery of the language of instruction. In all subjects, it is possible to read, write, speak, listen, and lexicons, and indeed all subject matters can be taught as if they were a second language. Joint development activity is an ideal place for establishing the vocabulary of the field of activity.
Language Development Indicators. The Teacher:

(a) Listen to students who speak about common subjects like home and culture.
(b) Answers the talk and questions of students and makes changes' in-flight' during conversations that directly relate to students' commentary.
(c) Supports the development of written and oral languages in deliberate conversations and writing by modeling, eliciting, checking, reiterating, clarifying, challenging, praising, etc.
(d) Interacts with students in ways that value student speech expectations that are different from teachers' expectations, such as attendance time, eye contact, turning, or concentrating.
(e) Connects students' language with knowledge teacher literacy and content field through speaking, listening, reading, and writing activities.

(f) encourages students to use the language of material to convey their understanding.
(g) It provides students with regular opportunities to communicate with each other and with the instructor during educational activities.
(h) Promotes the use of first and second languages for teaching.

3. ***Contextualization:*** Making sense: Linking schools to the lives of students. In daily settings, the high literacy targets of schools are better accomplished. This contextualization uses the information and skills funding of students as a framework for new knowledge. This approach encourages pride and trust and increases school results.
Rising contextualized education is an ongoing recommendation by researchers in education. Schools generally teach rules, abstractions, and verbal descriptions. Schools need to support at-risk students by offering interactions that display abstract ideas applied and extracted from daily life.
"Understanding" means linking new learning with previous experience. Helping students develop these relationships improves newly learned skills and enhances student interest in learning activities. Scheme theorists, cognitive scientists, behaviorists, and psychological anthropologists believe that school learning becomes meaningful by linking it to students' personal, family, and community experience. Successful education teaches how to draw and apply the abstractions of schools in the real world. Parent and community collaboration will show acceptable engagement patterns, interaction, awareness, and interests that mean literacy, numeracy, and science to all students.
Contextualization Indicators. The teacher:

(a) Starts activities with what students already know from home, community, and school.
(b) Develop educational programs that are relevant in terms of local community values and awareness for students.
(c) Acquires local values and information by listening to pupils, parents or family members, group members, and reading-related documents.
(d) Helps students communicate and apply their learning in their homes and communities.
(e) plans to build community-based learning opportunities together with students
(f) provides opportunities for parents or relatives to take part in educational programs in the classroom.
(g) Activities vary from mutual and cooperative to individual and competitive interests for students.
(h) Varied discussion forms and interaction to include the students' cultural preferences, including co-narration, call-and-response, and choral.

4. ***Challenging activities:*** Teaching Complex Thinking. Students at risk of failure, particularly those with poor standard English skills, often forgive academic difficulties if they have limited capacity or are forgiven for genuine appraisal of

success because the evaluation tools are insufficient. This weakens both expectations and reviews, with the inevitable consequence of impending achievement. While these measures are often the product of benevolent intentions, the effect is to deny many different students the essential needs for success — high academic expectations and substantive evaluations that provide input and support.

Educational experts strongly agree that students at risk of education failure need cognitively demanding training, education involving reflection and examination, not just routine, comprehensive training. This does not mean ignoring or storing multiplication tables, but it does mean pursuing the deepest possible scope of fascinating and relevant materials beyond the curriculum's level. In educating students at risk of educational failure, cognitive sophistication has been implemented in several respects. For example, a bilingual program itself poses cognitive difficulties that make it superior to the monolingual approach.

Working with a cognitively challenging curriculum requires diligent work leveling so that students are encouraged to stretch. It does not mean exercises for drilling and killing or daunting challenges that deter effort. The right balance and adequate assistance are a genuinely cognitively, demanding task for the teacher. Challenging Activities Indicators. The teacher:

(a) Ensures that students – with any subject – see the whole picture as the basis for understanding the parts.
(b) Presents demanding student success expectations.
(c) Designs teaching activities that encourage comprehension of students to more complex levels.
(d) Allows students to grasp more complex understanding by building on their previous achievement.
(e) It offers straightforward, direct input on how students' performance corresponds to the tough expectations.

5. ***Instructional Conversation:*** Teaching Through Conversation. The best way to think and share ideas is through dialogue, questions, and sharing ideas and information. In the Instructional Conversation (IC), the instructor listens attentively, guesses about the expected importance, and changes the answers to students' effort, such as graduate seminars or between mothers and children. The instructor relates the school's formal knowledge to the pupil, the family, and the student's knowledge. The IC offers opportunities for the development of languages of instruction and subject matter. IC is a collaborative and supportive event that develops a sense of intersubjectivity and community. IC individualizes training; is best exercised during joint productive activity; is suitable for the production of languages; and offers a responsive contextualization and an accurate, cognitive challenge.

   This concept could seem paradoxical; instruction implies authority and preparation, while conversation implies equality and reactivity. However, the IC is focused on assumptions that vary fundamentally from conventional lessons. Like parents in natural education, teachers who use them believe that the student has more to say in the mind of an adult beyond the established answers. The

adult listens attentively, guesses the context, and changes answers to assist the student — that is to say, engages in conversation. This dialogue demonstrates the learner's awareness, skills, and beliefs – the community – so that teachers can contextualize teaching to suit the student's experience base.
The educational discourse is unusual in US schools. Learning is also achieved through the recitation script in which the teacher assigns and reviews frequently. Classrooms and schools are turned into communities for learners by such dialogue teaching when teachers decrease their distance among them and their students by creating lessons from mutual knowledge of each other's experience and ideas and making teaching a warm, interpersonal and collaborative activity.
Instructional Conversation Indicators. The teacher:

(a) Arrange the classroom to accommodate normal and frequent interaction between the teacher and a small group of students.
(b) Has a strong academic aim that drives student discussion.
(c) ensures that student speech takes place at higher rates than teacher speech.
(d) Guides the discussion to include the opinions, assumptions, and rationales of students using texts and other material help.
(e) ensures that all students are included according to their interests in the discussion.
(f) Listen closely to determine the level of comprehension of students.
(g) Supports students to teach them by questioning, restating, appreciation, motivation, etc.
(h) Guides students to create a product reflecting the goals of the instructional discussion.

8.1.6 The Future of Pedagogy in Education

In the last 100 years, the world has changed drastically, and the teaching style of the past had to adapt significantly to hold the people of the future up and represent them.

Changes include strong demographic changes, numerous modern families, population migration, more trained parents, mothers with strong job commitments but also homework commitments, health concerns such as growing child obesity, technological trends, and access, technological lack of data security, and economic shift from the local resource to the global economy of information, changing modalities. The biggest influence on learning is mutual effectiveness. As educators, all factors that enhance learning and have the greatest impact must be acknowledged and enforced (Barton, 2019). These are the iceberg tips of the many reforms that are happening to enhance learning for all students.

As an educator, we need to improve and adapt our instruction to all students continually. We must help students understand what they understand and why and whom they can do next or who should ask to help improve self-efficacy (Barton,

2019). Our enthusiasm and knowledge are unbelievably high and must continue to inspire our students.

The days of working in isolation as a teacher have ended; communication and collaborations are essential to improving collective productivity learning and working together to 'know your effect.' Student-centered coaching is one of the strongest methods of gathering, evaluating, and engaging in all school cultures.

It is important to design pedagogies that produce meaningful learning through educational concepts, skills, content, assessment, learning, and teaching.

8.2 Learning Analytics Based Pedagogical Framework

Learning analytics is an evolving technical practice and a multidisciplinary research discipline to facilitate successful learning and learning knowledge. Ville Heilala has incorporated the knowledge discovery process, pedagogical knowledge concepts, learning analytics ethics, and microservice architecture in his design science research (Heilala, 2018). The outcome is a pedagogical learning analytics framework. The system aims to use learning analytics in practice.

Automated and ethical learning analytics are designed to address ethical, analytical, and automated problems. Automated and ethically performed learning analytics will provide teachers with new and practical insights by using applicable learning process insights. Ville Heilala referred to this form of research as pedagogical learning analytics (Heilala, 2018). It can be represented as a process cycle (Fig. 8.2).

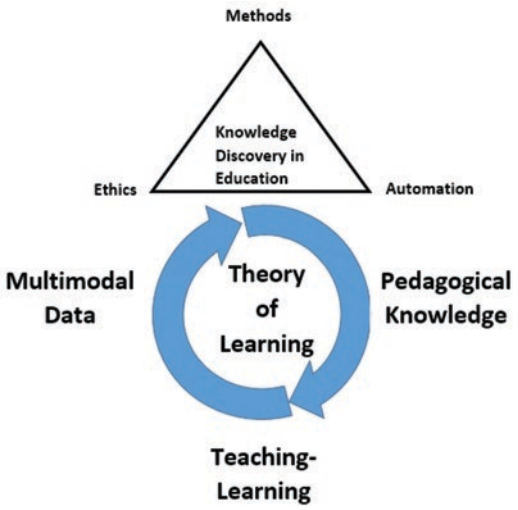

Fig. 8.2 Conceptual model of pedagogical learning analytics cycle for providing novel and useful knowledge about learning processes (Heilala, 2018)

8.2.1 Pedagogical Learning Analytics

Pedagogical learning analytics uses the educational knowledge discovery process to provide valid, innovative, and valuable knowledge that teachers can use to build and enhance teaching-learning situations and environments across subjects (Heilala, 2018). Combining this definition with the philosophy of the learning analytics cycle (Clow, 2012) and broadening the meaning of education data with multimodality (Blikstein & Worsley, 2016), Ville Heilala sketches the concept model of pedagogical learning analytics cycle (Fig. 8.3).

The focus of the pedagogical learning analytics study cycle (Fig. 8.3) is on scientific theory and knowledge about learning (1). An ultimate understanding of how people learn provides the basis for pedagogical learning analytics. For example, learning theories might guide as to what types of data are required. The actual learning occurs when students and teachers take action to teach and learn to achieve successful learning (2). These activities generate multimodal data of different kinds (3), which are collected and registered. The ethical and automated information retrieval method uses knowledge discovery and data mining (4). The knowledge discovery process outcomes are pedagogical knowledge (5), which leads to teaching and learning. Pedagogical learning analytics can be constructive feedback as new information about learning generally may lead to knowledge gained from the knowledge discovery process.

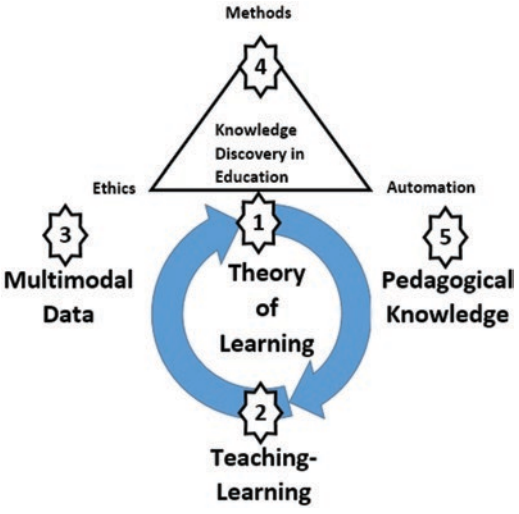

Fig. 8.3 Pedagogical learning analytics cycle (Heilala, 2018)

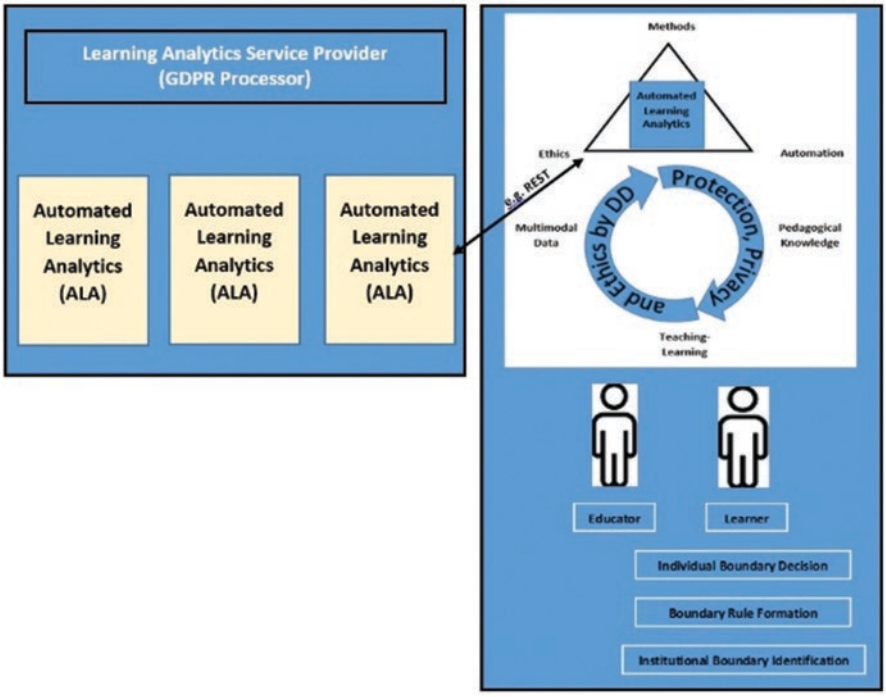

Fig. 8.4 Framework for pedagogical learning analytics (Heilala, 2018)

8.2.2 Framework for Pedagogical Learning Analytics

The definition of pedagogical learning analytics (Heilala, 2018) is based on the framework (Fig. 8.4). Pedagogical learning analytics is an analytics cycle that provides teachers with pedagogical knowledge. Teachers will use this expertise for their pedagogical knowledge base as a building block.

Pedagogic learning analytics begins with the relationship between teaching and learning. This interaction produces various types of multimodal data tracks that are collected and documented. The automated educational knowledge discovery process is based on learning theory. The analytics create educational information that the teacher can use in the interaction of teaching-learning.

Legal regulation and learning analytical ethics (e.g., GDPR) constitute the basis for LAP (Learning Analytics Policy) and system design as a whole. The system design follows protection, privacy, and ethics principles by design and default. The LAP defines the concepts used in educational institutions for the use of learning analytics. The learner assesses these values with his personal privacy needs.

Educational organizations may use external service providers to supplement their analytical repertoire. A service provider can be treated as a GDPR data processor when the data is only used on behalf of an educational institution and not for any

other purpose. In any event, the processor must comply with legal requirements, policy on learning analytics, and other agreements with educational institutions.

Automation uses the architecture of microservices. The advantages of the design are derived from studying analytical services. They can be programmed with various programming languages as autonomous and decoupling services. Analytical tasks can be divided into separate services, and more complex services can then be created. Services communicate via Representational State Transfer that enables the architecture of client-servers and a standardized interface. Therefore, services are also replaceable and upgradable as they rely on each other and clients' implementations.

8.3 Pedagogical Interventions

Wise (A. F. Wise, 2014) stresses the general value of intervention design, putting it within the wider landscape of the field of learning analytics and then discusses particular issues of intervention design for students to use learning analytics. Four principles of pedagogical learning analytics intervention design to support the productive use of learning analytics by students that can be used by teachers and course developers are introduced.

- Integration
- Agency
- Reference Frame
- Dialogue

Furthermore, three main processes for engaging students are described:

- Grounding
- Setting goals
- Reflection

These principles and processes form a preliminary model of student intervention design for pedagogical learning analytics, provided as a starting point for further inquiry.

8.3.1 Classes of Pedagogical Interventions

Two classes of pedagogical interventions were defined by Wise (A. F. Wise, 2014).

1. ***Pedagogical interventions for Teachers:*** Lockyer and his colleagues examined many of the key questions relating to the teachers' use of learning analytics (Lockyer, Heathcote, & Dawson, 2013). Their approach to the understanding and flow problems consisted of harmonizing learning analytics with the learning

design process. This produces a unified cycle in which teachers record their pedagogical intentions through learning design, which then provides the conceptual basis for the questioning and the interpretation of the theoretical knowledge presented (Dawson, 2011). Lockyer and colleagues underline the need to define, before time, what tasks trends of successful (or unsuccessful) student participation in the pedagogical design are anticipated and to use instruments like checkpoints and process analysis to look at these at certain points during the learning activities (Lockyer et al., 2013). This is significant because, depending on the task design, the same pattern of a task in a system can be considered more or less productive.

In answering questions of interpretive structures and the flow of action, Lockyer's model describes a pedagogical intervention by which teachers will systematically attempt to use analytics as a productive aspect of their daily teaching practice (Lockyer et al., 2013). Of course, other pedagogical interventions can also encourage teachers' use of learning analytics, but this is currently one of the few explicitly defined models.

2. ***Pedagogical Interventions for Students.*** Contrary to teacher use, student intervention design has received less consideration. In many situations, merely having well-designed analytics is considered to be enough for effective use. There are also many reasons to address this. One of the major problems is that students are often not aware of their teachers' pedagogical aims and, therefore, are not aware of the instructional activity's learning objectives and the development patterns of participation. The strong metacognitive skills required in analytics to be a tool for reflection and self-regulation are further challenges for students (Butler & Winne, 1995). Although teachers may have had training or knowledge of reflecting (Schon, 1986), students also fight as self-regulating students. The difficulty of understanding pedagogical intentions, identifying effective market patterns, and activation of self-regulatory challenges indicates that students themselves are unlikely to know how or why to use analytics. However, they also provide opportunities to make the students more active partners in managing their learning. The precise relationship between students' participation in an educational activity and their perception of the activity and its meaning (Knowlton, 2005) will enhance the ability to match student actions and the educational target by communicating pedagogical intentions. Also, being involved and engaged in directing one's learning promotes better learning processes and outcomes more generally (students' participation Dawson, 2011; Zimmerman, 1990), so that students can continue to gain in other academic areas as part of their use of analytics, especially by increasing customized methods of learning that position area Finally, encouraging students to be part of their learning training will enable analytics to act as an agent of empowerment instead of enslavement.

   In the light of such possible benefits (A. F. Wise, 2014), it answers concerns about intervention design for student use of learning analytics and provides a collection of pedagogical concepts and processes that teachers and course developers should use to promote the efficient use of student learning analytics.

Although the traces, analytics, and particular intervention of learning analytics needed in a given situation are unique to that context, the study model can be defined in terms of general principles and processes that can be extended to a range of learning contexts for the framing of interpretive behavior by students.

8.3.2 Principles for Pedagogical Learning Analytics Intervention Design

Principle 1: Integration The integration theory is fundamental to the basic definition of pedagogical intervention design. This suggests that the pedagogical intervention design is intended to provide an atmosphere for the operation in which analytical instruments, data, and reports are taken up. Simultaneously, the integration theory says that the research should be an integral part of the activity linked to objectives and aspirations in this context. This principle explicitly tackles the challenge of helping students understand pedagogical intentions and helps avoid the rigidity of interpretation by establishing a local context to understand the data. It also facilitates the incorporation of analytical software into the learning environment operation flow. It also offers a way of customizing analytics so that the same analytical suite in different contexts can be used in different ways.

The basic principle of integration is that the use of learning analytics must be understood and that the students must recognize these relations as an aspect of the learning design itself. For this reason, the teacher or learning designer needs to determine in the plan of a learning event which metrics (of those offered by any method used) are to concentrate on in a given situation based on the intent of the education operation and to define the productive and unproductive trends in these metrics. This preparation process is related to the principle of aligning learning analytics with learning design as part of the teacher pedagogical intervention model (Lockyer et al., 2013).

The pedagogical learning analytics intervention design requires two additional main elements and selecting metrics and predicting patterns. A strategy to communicate the link between learning analytics and learning activity with the students is the first additional aspect so that the link between goals, actions, and feedback is clear. This is conceptualized as a process of Grounding.

The second aspect is understanding when and how students can work with the selected analytics concerning the learning environment's activity flow. In certain situations (for example, with students who have encountered self-regulation), it might be good to provide students with a background at the beginning of their learning experience and leave them alone to determine whether analytics can be incorporated into individual learning processes. However, it can be helpful (or even necessary) to direct students when the study can be consulted in certain situations. This can be enforced by creating a schedule or timescale for control points that

make sense of the operation involved. The problem of temporal integration is part of the Goal-Setting and Reflection process.

Principle 2: Agency Learning is a students' task to excel (Zimmerman, 1990). The opportunity to assist the learner in effectively controlling his learning process is a central attraction to learning research (Govaerts, Verbert, Klerkx, & Duval, 2010). Therefore, the Agency's principle aims to encourage learning analytics interventions that promote rather than hinder students' production and self-regulatory skills. This also answers fears that analytics is another master for students to serve rather than a power tool. In thinking of the student agency, there are two important elements: firstly, the interpretation agency (what the information is given means, how does this contribute to what is important to me in this situation), and secondly, the agency to respond to the measure. Each of these components is addressed through the processes of Goal-Setting and Reflection.

Principle 3: Reference Frame In addition to the two main Integration and Agency principles, there are two other intervention design principles to encourage the production use of analytics. The first is the reference frame principle. A benchmark is essentially the point of reference on which students concentrate on their study.

Firstly, the course instructor defined the theoretical activity patterns as efficient, which serve as an absolute point of reference for comparison. The second is a previous activity for a student that is a relative point of reference for comparison. The teacher may choose to emphasize one another, depending on the nature of the analytics' use. The third frame of reference that can be used is the one used by other students. Aggregate performance information for other students is also given in analytical frameworks and can show a student where they are compared to other students in a class (Govaerts et al., 2010) but can have some negative potential effects as well (A. Wise, Zhao, & Hausknecht, 2014). So how other students' comparison system is put in an essential component of pedagogical intervention design.

Specifically, other students' performance can motivate underperforming students who may first not understand how their actions are guided towards others. However, this reference system can also lead to competitive conduct or be overwhelming and intimidating for some students. Also, aggregated class statistics like averages are likely to become goals for students, which may or may not be sufficient based on the class's activity profile. When students only find out the method, the analytical patterns shown cannot be ideal or practical goals at the beginning of a course. Furthermore, measurements of the class's central tendency (especially the average) can be affected by some students' activities or inactivity. Recent work looking at student activity MOOCs reveals that a considerable proportion (40–80%) of the population participating in the course study did so to "sample" the course (Kizilcec, Piech, & Schneider, 2013); in this case, central tendency metrics will be a flawed benchmark for one's activities.

A number of the above-mentioned problems can be solved by the careful design and refining of analytical tools, e.g., processing data to provide aggregate measures for only similar categories of students or to provide aggregate variance measures

and core trends. However, intervention designs often have an important role in helping students prioritize the benchmarks, peers, and expectations for their actions and recognize the principles and limitations of peer references given within a particular context. This knowledge is available in advance as part of the initial goal-setting process, during the learning activity, or through the individual dialogue mentioned below.

The Student Activity Meter, for example, is a learning analytics system that offers learners route maps, bar charts, and coordinate displays showing how they compare with their peers about metrics such as working time, the number of seminars they attend, and the number of services they use (Govaerts, Verbert, Duval, & Pardo, 2012). This toolkit advocate using a peer comparison system when analyzing the data, although the line chart enables students to observe shifts in their work habits over time.

This analytical tool's pedagogical action may take many different forms to promote effective comparative behavior while protecting against a detrimental competitive mindset. External expectations for planned operation can be set in certain courses. If, for example, it is understood that there are a limited number of resources to be consulted in general for a project to succeed, this amount can be stressed to students as a fixed guide for measuring progress from the outset. Similarly, if the teacher knows that students appear to be more effective if they are engaged in a smaller number (rather than several brief ones) of intensive work, then they can be encouraged to work towards a line chart pattern which involves periods of steep rise rather than an only higher time.

If absolute metrics are more difficult to provide, a pedagogical intervention can concentrate on the individual frame of reference, specifically requiring that students keep track of their progress or progress towards the community and to set targets for them. Another strategy may concentrate on collaborative efforts to allow the class to use analytics as a diagnosis community to help each other move forward. Each intervention design's main purpose is to help students avoid the simplistic mindset of "more (than other students) is better."

While it is necessary and useful to know where one is about his or her peers, in some cases more than other cases (usually or for that particular student) may still be inadequate, in others everyone is already far beyond the limit, making additional effort to boost a particular metric waste effort. If all students always strive to overpower everyone else, it can also unintentionally produce an attractive impact.

Principle 4: Dialogue The introduction of learning analytics includes questions of power and access to analytics (Duval & Verbert, 2012). The concerns relating to these questions can be answered to some extent by the concept of dialogue; that creates a space to negotiate the understanding of analytics, in which data serves as a tool for reflection and discussion, rather than for the teacher, data on the students are collected. This complements the agency concept in which students are encouraged to set targets and focus on their analytics and encourages students to engage in this process.

Since many online journaling tools such as wikis and blogs encourage interactivity between individuals, a dedicated space for reflection can easily be used as a common space between students and teachers, or even between student groups. For example, as an example of a purposely generated space, EnquiryBlogger has provided teachers (and other students) with functionality to access and comment on blog entries and search for entries with unique learning provisions (Ferguson, Buckingham Shum, & Deakin Crick, 2011).

There are numerous benefits to dialoguing the process of reflection. First, a shared journal provides an audience for writing and encourages the student to hear his voice. In particular, students should include details that the teacher does not understand on its own (e.g., "I was having a very rough time in this section of the assignment," "I have tried extra hard this week," "I know I need to express my thoughts even more, but I do not always feel sure I have the right idea"). Secondly, it provides the teacher (or designate) the opportunity to review student interpretations of targeting and analysis and react as appropriate to resolve confusion, repair uncertain interpretations, or realign objectives.

Finally, in some situations, students can define targets based on their analytics, but they do not know how to advance them, so a dialogical space encourages them to ask for guidance, and the teacher can provide suggestions or solutions. Via collaborative journal writing, the process of reflection (Andrusyszyn & Davie, 1997) can be actively encouraged, and a checkpoint for students' positive self-regulatory routes. Also, the analytics itself facilitates discussion by serving as a third "voice" in the conversation.

This gives the teacher a neutral object to which he can refer in conversation usefully (for example, "you see that your level of attendance is different from that of the rest of the class" instead of "you need more participation"). The biggest obstacle in applying the dialogue theory is the question of scale. The instructor will communicate reasonably much with all the students in a small class, but as the student-teacher ratio increases, it becomes more challenging and is not feasible for large open online courses. However, two potential alternatives to facilitate analytical dialogue may be conceivable. First of all, a tiered structure may provide the principal dialogue partner for teaching assistants or student leaders with problems or questions posed to the teacher if appropriate.

Secondly, students may be able to help each other in some situations through partnership or triad models. The problem here is the students' lack of expertise and ability to effectively help each other, so this strategy will better work with students who are reasonably experienced in analytics to support their learning.

8.3.3 Processes for Pedagogical Learning Analytics Intervention Design

Process 1: Grounding There are three elements which students need to recognize to use analytics effectively to participate more effectively in a learning activity:

1. the purpose of the learning activity,
2. the characteristics of what is known as productive engagement in the activity and
3. How this is expressed by the learning analytics given.

Such understanding can be established in many ways. The objectives of the learning activity can, for example, be explained and explained to students according to the criteria of the learning background (student maturity, the class size, mixed or completely online format, time available, etc.) or maybe jointly decided by the teacher and the students. Similarly, active participation characteristics can be brainstormed and then finalized by the group or just given a justification. Both of these exercises (which aim at a mutual understanding of the teacher and students' intent and process) are also useful for helping students participate in the desired manner before the research is applied and can be implemented fairly in many ways, both face to face and in digital environments. Furthermore, the analytics available must be related to the accepted attributes of effective participation. The extent to which the various metrics' measurement specifics will be clarified and analyzed will differ according to the students' level, time available, and perceived value. Of aspect mentioned here is a compromise between the efficiency of presentation and profound student involvement. However, irrespective of the founding process's intent, a common understanding of the qualities of effective participation in the activity is established as a framework for the study.

Another important argument here is that it is a valuable exercise to see which metrics serve as measures and emphasize any qualities of efficiency that cannot be taken by the metrics to connect the analytical products available with the qualities of the production commitment. In applying learning analytics, one significant issue is that measurement can alone determine how people participate in the learning activity, and so will "become what we measure," even though these measures capture only some aspects of the overall activity (Clow, 2012; Duval & Verbert, 2012). It is also necessary for students to know what the analytics they use do not catch. It is also beneficial to take different steps so that no analytics are the only priority (A. Wise et al., 2014). To offer a clear example of the principle of integration and grounding processes, take the Uatu analysis framework for Google Docs (McNely, Gestwicki, Hill, Parli-Horne, & Johnson, 2012) to imagine collaborative writing. To facilitate the formative evaluation of cooperation between learners, the framework constantly collects and stores data on user inputs, changes in documents size, and time from Google Docs. The database visualizations include the document's revisions as they had happened over time and indicate who made those revisions when the revisions took place, the scale, and the amount of time spent.

If the teacher imagines that this tool will be used as part of an online post-secondary history class, he may first incorporate collective writing to improve subject awareness and comprehension of key issues through the continuous expansion of key themes across the course term.

She will then provide students with specific instructions about what is anticipated and what will be measured, e.g., the frequency, size, and consistency of the feedback. In this respect, the study should be incorporated to explain how the input visualizes the document's collaborative structure and how it applies to participation requirements. For example, as students go through the semester, the teacher will add to the document by defining or adding a theme every week to explain each contribution's amount of detail. The Uatu framework does not currently include quality measures, which should be addressed as an essential factor for the operation, although it is not included in the measures. This may also be addressed in cases where the analytical method offers details on the quality of contributions. This introduces analytics as to the knowledge that has a simple meaning in the sense of this unique collaborative writing practice. With other students and another form of writing, a different intervention design will inspire the same analytics suite productively in an alternative context.

Process 2: Setting goals In self-regulation, students direct their learning process through the concept of goals and the active work to achieve them (Schunk & Zimmerman, 2003). Goals will inspire students to make greater efforts to predict themselves and to track their accomplishments. In particular, self-set goals lead to increased self-efficiency, which influences learners' effort and commitment to meet the challenges (Zimmerman, Bandura, & Martinez-Pons, 1992). However, students need guidance to develop proximate and clear goals with the right learning level (Schunk, 1990). It might seem like these discussions are superfluous, as students will all strive to optimize each of these qualities after gaining a common understanding of the purpose of educational activity and the qualities of output participation.

However, this statement is unnecessarily simplistic as students can often set their objectives for a learning activity, others less so in line with the activity's educational goals (Butler & Winne, 1995). Moreover, each student has a different starting point and skills they have to learn so that each student has different aspects of the learning activities that need more focus than others, even to achieve the same end state. This indicates the need for many potential output and development profiles rather than for a common purpose and direction to be pursued by all students.

For these purposes, a key aspect of the learning analytics organization starts with an individual target concept to establish a personal meaning for analytics. By making individual objectives an explicit and organized part of the learning experience, learners are asked to consider the specified tasks, identify their strengths and limitations, and set clear and proximal objectives. Importantly, the process of setting goals should be linked to and followed by the establishment of the target of learning operation, as described in the integration principle. This allows learning analytics to

facilitate the generation of precise and proximate objectives as they provide consistent indices for the setting of targets.

The actual goal-setting process does not have to be carried out explicitly in the learning analytics system, although there are many benefits to this, namely the ability to endorse initial goals and consistent reference as analytics are checked. nStudy, a web-based toolkit designed to help students learning online content by annotating (e.g., creating tags, notes, and definitional terms) and connect these knowledge objects to construct concept maps and the like (Winne & Hadwin, 2013). While efforts are still ongoing to improve learning analytics for the system, nStudy supports learners to achieve goals through a process that enables them to identify themselves and offers tools for showing importance, difficulty, target date, and current status. An educator who uses nStudy to teach could organize this goal-setting functionality specifically into some points in the term, requiring students, for example, to set goals at the beginning of each section of the course. There are also possibilities to exchange details on the entire class's aggregated goals using such a method. Whether this is helpful or harmful for setting goals and learning remains an open question of science. Objective notes in nStudy are easily identified, modified, and related to other objects in the system. After the system's analytical features are given, reports or a dashboard may also be connected to the targets, enabling reflection of the analytical indicators, along with particular purposes and goals.

Process 3: Reflection When set, the goals drive how students engage with education resources and activities, and the input generated by analytical technology will be a significant moderator for students to track and measure their progress towards their objectives (Locke & Latham, 2006), and decide when they have to update or modify the goals themselves. This series of activities include the review of information on recent learning activities and a data-informed reflection method. Reflection was long considered an important aspect of building one's understanding from a constructivist perspective; in turn, reflections can also be used more efficaciously to support learning as one's understanding grows (McAlpine & Weston, 2002). However, reflection historically relied upon the student's own set of events, which have not been especially good studies (Veenman, Van Hout-Wolters, & Afflerbach, 2006). Thus, learning analytics provides an essential advantage in supporting the reflection process based on more detailed results. In addition to setting goals, however, students need guidance in learning when and how to focus on and take action based on analytics. This is important, particularly because online activities can occur anywhere and sometimes never anywhere (Jun, 2005); conversely, attention to the constantly available analytics can draw from involvement in the activities. Thus, explicit time, space, and guidelines for reflection on analytics are needed to promote effective reflective practice. Time may be highly organized by focusing on particular course activity or offering suggested guidance to students. It is necessary to provide analytical feedback quickly enough to affect the methodology (Shum & Crick, 2012) and at a level that makes sense for analytics to analyze in a specific context. The time-frame over which the data are analyzed can dramatically impact the results, particularly for analytics that track larger constructs (Zeini, Göhnert,

Hoppe, & Krempel, 2012). The pace of study or access and reflection depends on the context, but creating a clear schedule prevents overwhelming students or render them over-reliant or analytical (Buckingham & Ferguson, 2012).

The notion of a dedicated space for reflection often encourages the actual execution of the method and the reflection of learners to look back on their success in learning over time. With historical documents, students can see their progress (or lack thereof), track their priorities, and get a clearer understanding of their learning activity participation. The most obvious alternative is maybe a blog format, with students who can express, refine, and represent their views, ideas, and opinions through writing in a journal (Ferguson et al., 2011). However, a wiki can also be used effectively for this reason (A. F. Wise, Zhao, & Hausknecht, 2013). Blogs and wikis also allow for interactivity between learners or between the student and the teacher and thus allow reflective journal writing to become a collaborative or dialogue-based practice (Andrusyszyn & Davie, 1997).

Finally, students need support in the reflection process. Many of these recommendations can take the form of just-in-time reminders to look back at their goals, evaluate previous analyses, and think about their success and the need for more effort. Reflective guidance may also be given by clear questions of reflection or a formal reflective method when needed. Another alternative is integrating reflection support into the analytical framework or implementing an analysis of the reflection process itself. The EnquiryBlogger framework supplies a reflective journaling approach, enabling students to mark their entries with a variety of useful learning arrangements (e.g., critical curiosity, strategic awareness), and offers visual analytics reflecting this understanding of their learning power (Shum & Crick, 2012).

8.4 A Preliminary Model of Pedagogical Learning Analytics Intervention Design

The problems associated with each of the above concepts are not separate and are, in fact, very closely connected. The reflection process, for example, is related to objectives, uses a reference frame, and is discussed with the teacher as part of a conversation, while integration is, in part, a meta-organizing concept that encapsulates all other concepts. A preliminary model incorporating the pedagogic learning analytics intervention design elements for students in Fig. 8.5 reflects these relationships (A. F. Wise, 2014).

This model is not an endpoint but a starting point to stimulate attention to intervention design in learning analytics. This model needs to be implemented, reviewed, validated, updated, and the awareness of other variables that can help students make use of learning analytics is needed.

To develop their more general usefulness and recognize the additional factors required to apply it and adapt it effectively to various learning analytical contexts, further applying the pedagogical intervention design models in other educational

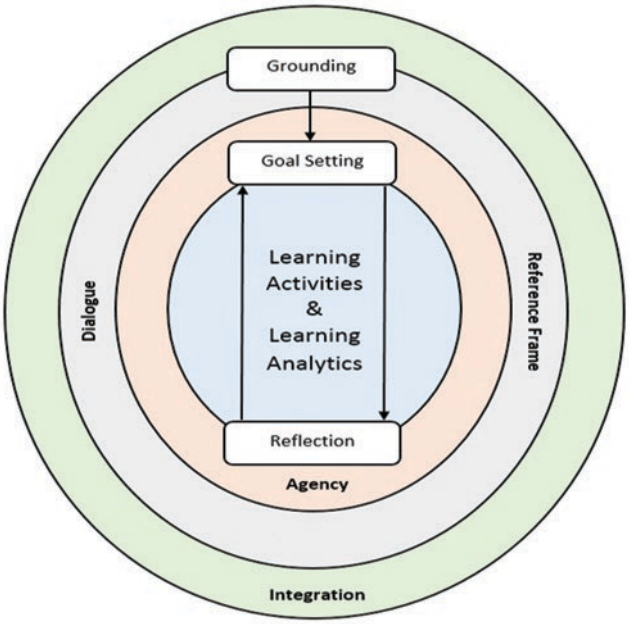

Fig. 8.5 A preliminary model of pedagogical learning analytics intervention design (A. F. Wise, 2014)

contexts involving various learning analysis applications and learners' populations is necessary.

8.5 Case Study: Newman University Birmingham's 'Collaborative Development of Pedagogic Interventions Based on Learning Analytics'

The project "Collaborative development of pedagogic interventions based on learning analytics" from Newman University Birmingham aimed to use student engagement activity data to drive pedagogic innovation.

8.5.1 Aims and Objectives

The main aim of the project was to enable more students to fulfill their potential. Emergent results indicate that this has been accomplished using the university's student-staff partnership framework to establish and incorporate data-informed

tutor and peer-led mentoring systems. In light of student engagement results, these provide tailored personal support at the subject and modular levels.

The original project goals and updates to project goals are given here:

1. 'Implement a contextualized and enhanced case management system to complement the JISC learning analytics solution to provide accessible and usable data on student engagement and progress.' Newman University has purchased SEAtS: a contextualized and enhanced student engagement activity and case management system that complements the JISC Learning Analytics solution; this offers accessible and valuable data on progress and student engagement.
2. 'Collaboratively develop pedagogic interventions through five student partnership projects across a range of discipline areas include Evolve's mentoring development program' - Through four student-staff partnership projects, they work in conjunction to create pedagogical interventions across a variety of areas, including Evolve's mentoring development program.
3. 'Implement pedagogic interventions, based on learning analytics, across four discipline areas and the Evolve mentoring program' — through seven student-staff collaboration initiatives, pedagogical interventions have been carried out in three disciplinary areas in the form of tutor and peer-led mentoring systems for a full academic year, based on the student engagement results, and the Evolve Mentoring Program.
4. 'Evaluate the interventions through five student partnership projects'– evaluation of the mentoring interventions in another four student-staff partner projects.
5. 'Improve student retention & performance data on the participating programs' -confirmation that student retention & performance in participating programs have been improved.
6. 'Develop and disseminate five student-produced case studies of pedagogic interventions to enhance student progression based on learning analytics.' Project findings have been disseminated internally and across the sector by seminars, conference papers, and article submissions and continue beyond completing the formal project.

8.5.2 Key Milestones

The project worked in three separate phases:

Phase 1 (December 2016–July 2017)
The project steering group and the internal institutional reporting mechanism have been developed. The Learning, Teaching, and Assessment Committee collected and agreed upon the following policy, student guide, and FAQs:

- Using Student Engagement Data policy
- Supporting student learning through information: a student guide
- Using Student Engagement Policy FAQs

Staff/Student Partnerships. Two student/staff workshops were conducted to help student/staff teams establish how to consult with students. They also initiated a discussion of the different pedagogical approaches to help the students in other situations. Student-staff projects across three subject disciplines and Evolve surveyed the student body on the most successful approaches for students experiencing issues in this area. An additional workshop complemented this on 17 June, which disseminated the first consultation results and improved piloting interventions in Phase 2. By 30 June 2017, Phase One project reports from each region have been sent to the Academic Practice Unit.

Preparation of data. The cross-departmental work between IT employees, then Student Records, and the Academic Practice Unit was carried out to identify and collect the data necessary to migrate Moodle and student records into the Jisc Learning Analytics warehouse. This included validating the data after they were sent to the warehouse via Jisc software to test data integrity. Key project employees at Jisc Pathfinder and Analytics network meetings continued involvement. Part-time job description decided on the role of the developer of IT analytics.

Case Management System. A webinar with Unicon on the Student Success Platform's institutional usage revealed that it was not adaptable in the UK's anticipation. The decision not to use SSP was followed, and market research on other CMS used in the sector was carried out. Jisc proposes 'Co-tutor': as a potential alternative to a sector-developed system.

Phase 2 (August 2017–October 2017)

Staff/Student Partnerships. A student/staff workshop was organized to show how student interaction data could be used as a basis for pedagogical interventions. In September 2017, Phase Two applications were submitted to the Academic Practice Unit detailing the planned actions to be carried out across Evolve, English, Youth and Community Service, Sport, and Health. In September 2017, the piloting of data-informed peer and tutor-led mentoring systems started. The assessment started simultaneously with pilots through interviews and focus groups.

Data. Continued compilation and student activity data validation. Data Explorer testing and initial discussions with Jisc on library data migration into Learning Records Warehouse. Part-time IT Analytics developer job advertising is done. Jisc Pathfinder and Analytics network meetings continued attendance.

Case Management System. JISC and Newman's interactions with the co-tutor failed to create a feasible framework. Software demonstration and initial discussions with SEAts. Additional CMS exploration within the sector.

8.5.3 Significant Inputs or Outputs

The project had to adjust repeatedly but delivered its main inputs and outputs. The most important feedback and subsequent outcomes of the project were to create, execute, and assess pedagogical interventions by creating a student engagement data and case management system and leading student partnerships.

Management of student engagement data. When the project started, the data challenges' magnitude created sufficient data on student participation, gathering it, validating it, and migrating it. Members of the core project team have done extensive work to accomplish this. This helped to create a single warehouse for truth data with Jisc. In addition to the development of accessible data, adequate data collection and use policies had to be created and enforced by the university. Jisc has done extensive development work to provide user input on its data warehouse and the Data Explorer system. Due to the delay in developing a functional system, JISC systems were used for a large part of the project, but SEAtS was eventually embraced by student interaction data and case management IT system. This required additional funding for the project by the University. Due to the delayed introduction of the case management system, SEAts has not yet been completely incorporated as originally intended with Newman University systems, although these efforts continue to underpin the project's feasibility.

Student staff partnership work. Four phases one student staff collaboration projects were undertaken, covering English, Youth and Community Work, Sport and Well-being, and Evolve. This collected student feedback about what would be effective pedagogical interventions to benefit students in their fields. Academic practice and the Tutor for Transition and Retention offered preparation and development for these and further project iterations. In Step II, these four groups adopted the suggested interventions. Due to the delay in determining a suitable IT framework, some funding has been reallocated to support three academic areas in the second round of intervention projects in the second half of 2017/18 at the interim report stage. Finally, in phase three, the student assessment programs were performed in all four regions. A total of 15 student-staff collaboration initiatives were undertaken in all.

The student-staff collaboration projects' learning was substantial, and the students were the main contributors to the project's distribution and assessment. Student stakeholders have engaged completely in the design, implementation, and assessment of individual and general projects. Their voice spread beyond Newman through workshops and other distribution events in Europe through the HEFCE Catalyst Fund.

The experience gained from working with students in collaboration facilitated closer and substantive connections between student-staff partners, leading to a shared understanding of each other's circumstances and obligations. Moreover, work within the university has helped the catalyst project establish multidisciplinary connections, which has generated interdisciplinary awareness between different staff and student groups, promoting student partners' personal and professional growth and improving their university evaluations.

8.5.4 Key Findings

It was found that using student engagement data to inform proactive peer and tutor-led subject-specific mentoring can assist in supporting the student transition into and through level four studies. The Catalyst project's qualitative evidence indicates that staff/student-student relationships will be established, a feeling of alienation reduced, and a sense of membership in new HE students promoted. Quantitative analysis shows an improvement in assessment submission rates and a substantial decrease in withdrawals and suspension at level 4 among the subjects concerned.

To make effective data-informed mentoring, it should be part of the university's larger support mechanism, as part of an integrated mentoring system where anyone can use, for example, not just those defined from engagement data. Also, a 'one size fits all' approach does not allow such pedagogical innovation to be built across all students' disciplines and communities. Such activities must be versatile and informal from the beginning to allow adaptation to the cohort, discipline, and need.

Staff stated that the provision of data-informed mentoring has been of value in several ways. In general, and significant, it has made it possible to promote student participation and experience as a learning environment.

On an individual level, the staff has recognized several accomplishments, including pro-active help for mentees and an organization that prioritizes work and home living. Qualitative data collected have enabled students to feel more able to cope with the transition to HE, create confidence, and understand how the university 'worked.'

Although this Catalyst project's emphasis does not lie in, the subject-specific awareness created by staff and students and between mentor and mentee has increased participation through discussions of the modules and specific evaluations. This has resulted in a further discussion of modules/courses/lecturers amongst mentors/mentors that can be very encouraging – i.e., the mentor shares his (relative) wealth of knowledge with the mentees and staff. The value of the subject-specific nature of mentoring is underlined in turn: it would be challenging to reach some kind of students who did not take the same/similar courses and went beyond superficial and signposted levels.

It is commendable to follow working methods that facilitate collaborations between students, technical staff, and support staff from various disciplines. This includes funding, trusting, listening, and working in ways that break down conventional power relationships. The human relationship at the sharp end of meeting student needs is central to the effective use of interaction data in pedagogical interventions. While big data will help prioritize assistance where it is needed the most, the most important thing for student development and achievement is caring human interaction.

8.6 Conclusion

The growing prevalence of learner-centered forms of learning and the increase in the number of students involved in various digital platforms and instruments contribute to an ever-rising stream of learning data. Learning analytics will better understand and forecast learning and success by the learners, teachers, and institutions. This chapter highlighted the value of pedagogical systems focused on learning analytics and pedagogical intervention design for students to use learning analytics.

8.7 Review Questions

Reflect on the concepts of this chapter guided by the following questions.

1. What is Pedagogy? What is the importance of Pedagogy in Teaching?
2. List and explain the factors that affect Pedagogy.
3. What are the various Pedagogical Approaches? Describe.
4. What are the standards for Effective Pedagogy? Explain in brief.
5. Write a note on the future of Pedagogy in education.
6. What do you mean by Pedagogical Learning Analytics? Describe.
7. With the help of a neat diagram, explain the Pedagogical Learning Analytics cycle.
8. Explain the framework for Pedagogical Learning Analytics.
9. What are the various classes of Pedagogical Interventions? Explain.
10. List and explain the principles & processes for Pedagogical Learning Analytics Intervention Design.

References

Andrusyszyn, M., & Davie, L. (1997). Facilitating reflection through interactive journal writing in an online graduate course: A qualitative study. *International Journal of E-Learning*. *Distance Education, 12*(1), 103–126. http://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=12900501&site=ehost-live

Barton, T. (2019). *Pedagogy in education*. Serve Learn. https://servelearn.co/blog/pedagogy-in-education/

Blikstein, P., & Worsley, M. (2016). Multimodal learning analytics and education data mining: Using computational technologies to measure complex learning tasks. *Journal of Learning Analytics, 3*(2), 220–238. https://doi.org/10.18608/jla.2016.32.11

Brown, B., & Eaton, S. E. (2020). Using a community of inquiry lens to examine synchronous online discussions in graduate courses. In L. Wilton & C. Brett (Eds.), *Handbook of research on online discussion-based teaching methods* (pp. 229–262). IGI Global. https://doi.org/10.4018/978-1-7998-3292-8.ch010

Buckingham, S., & Ferguson, R. (2012). Social learning analytics published by: International forum of Educational Technology & Society Linked references are available on JSTOR for this article. *Journal of Educational Technology & Society, 15*(3), 3–26.

Butler, D. L., & Winne, P. H. (1995). Feedback and self-regulated learning: A theoretical synthesis. *Review of Educational Research, 65*(3), 245–281. https://doi.org/10.3102/00346543065003245

Clow, D. (2012). The learning analytics cycle: Closing the loop effectively. *ACM International Conference Proceeding Series*, 134–138. https://doi.org/10.1145/2330601.2330636

Dawson, S. (2011). 'Seeing' networks: Visualising and evaluating student learning networks final report 2011 report authors: Dr Shane Dawson Ms Aneesha Bakharia Professor Lori Lockyer Ms Elizabeth Heathcote.

Duval, E., & Verbert, K. (2012). Learning analytics research issues. *E-Learning & Education, 1*(8), 7–11.

Ferguson, R., Buckingham Shum, S., & Deakin Crick, R. (2011). EnquiryBlogger: Using widgets to support awareness and reflection in a PLE Setting. *Proceedings of the The PLE Conference 2011*, *September 2015*, 28–32. http://oro.open.ac.uk/30598/

Goodyear, P. (2005). Educational design and networked learning: Patterns, pattern languages and design practice. *Australasian Journal of Educational Technology, 21*(1), 82–101. https://doi.org/10.14742/ajet.1344

Govaerts, S., Verbert, K., Duval, E., & Pardo, A. (2012). The student activity meter for awareness and self-reflection. *Conference on Human Factors in Computing Systems - Proceedings, 110067*, 869–884. https://doi.org/10.1145/2212776.2212860

Govaerts, S., Verbert, K., Klerkx, J., & Duval, E. (2010). Visualizing activities for self-reflection and awareness. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *6483 LNCS* (June 2014), 91–100. https://doi.org/10.1007/978-3-642-17407-0_10

Heilala, V. (2018). Framework for pedagogical learning analytics. *University of Jyväskylä Faculty of Information Technology*, 1–84.

Jun, J. (2005). Understanding E-dropout? *International Journal on E-Learning, 4*(2), 229–240.

Kizilcec, R. F., Piech, C., & Schneider, E. (2013). Deconstructing disengagement: Analyzing learner subpopulations in massive open online courses. *ACM International Conference Proceeding Series*, *February 2014*, 170–179. https://doi.org/10.1145/2460296.2460330.

Knowlton, D. S. (2005). A taxonomy of learning through asynchronous discussion. *Journal of Interactive Learning Research, 16*(2), 155–177.

LearningPortal. (2018). *Effective and appropriate pedagogy*. Learning Portal. http://learningportal.iiep.unesco.org/en/issue-briefs/improve-learning/teachers-and-pedagogy/effective-and-appropriate-pedagogy

Locke, E. A., & Latham, G. P. (2006). New directions in goal-setting theory. *Current Directions in Psychological Science, 15*(5), 265–268. https://doi.org/10.1111/j.1467-8721.2006.00449.x

Lockyer, L., Heathcote, E., & Dawson, S. (2013). Informing pedagogical action: Aligning learning analytics with learning design. *American Behavioral Scientist, 57*(10), 1439–1459. https://doi.org/10.1177/0002764213479367

McAlpine, L., & Weston, C. (2002). Reflection: Issues related to improving professors' teaching and students' learning. *Teacher Thinking, Beliefs and Knowledge in Higher Education*, 59–78. https://doi.org/10.1007/978-94-010-0593-7_4

McNely, B. J., Gestwicki, P., Hill, J. H., Parli-Horne, P., & Johnson, E. (2012). Learning analytics for collaborative writing: A prototype and case study. *ACM International Conference Proceeding Series*, 222–225. https://doi.org/10.1145/2330601.2330654

Schon, D. A. (1986). The reflective practitioner: How professionals think in action. *The Journal of Continuing Higher Education, 34*(3), 29–30. https://doi.org/10.1080/07377366.1986.10401080

Schunk, D. H. (1990). Goal setting and self-efficacy during self-regulated learning. *Educational Psychologist, 25*(1), 71–86. https://doi.org/10.1207/s15326985ep2501

Schunk, D. H., & Zimmerman, B. J. (2003). Self-regulation and learning. In *Handbook of psychology self-regulation* (pp. 59–78), Wiley: New York, United States.

Shum, S. B., & Crick, R. D. (2012). Learning dispositions and transferable competencies: Pedagogy, modelling and learning analytics. *ACM International Conference Proceeding Series*, *May*, 92–101. https://doi.org/10.1145/2330601.2330629

Teaching Tolerance. (2020). *Five standards of effective pedagogy*. Teaching Tolerance. https://www.tolerance.org/professional-development/five-standards-of-effective-pedagogy

TES. (2018). What is pedagogy? *Pedagogical Seminary*. https://doi.org/10.1080/08919402.1905.10534667

Veenman, M. V. J., Van Hout-Wolters, B. H. A. M., & Afflerbach, P. (2006). Metacognition and learning: Conceptual and methodological considerations. *Metacognition and Learning, 1*(1), 3–14. https://doi.org/10.1007/s11409-006-6893-0

Winne, P. H., & Hadwin, A. F. (2013). nStudy: Tracing and supporting self-regulated learning in the internet. *Midlands State University Library, 28*, 293–308. https://doi.org/10.1007/978-1-4419-5546-3

Wise, A., Zhao, Y., & Hausknecht, S. (2014). Learning analytics for online discussions: Embedded and extracted approaches. *Journal of Learning Analytics, 1*(2), 48–71. https://doi.org/10.18608/jla.2014.12.4

Wise, A. F. (2014). Designing pedagogical interventions to support student use of learning analytics. *ACM International Conference Proceeding Series*, 203–211. https://doi.org/10.1145/2567574.2567588

Wise, A. F., Zhao, Y., & Hausknecht, S. N. (2013). *Learning analytics for online discussions: A pedagogical model for intervention with embedded and extracted analytics* (p. 48) https://doi.org/10.1145/2460296.2460308

Yadav, K. (2020). *Effective pedagogical approaches*. Evelyn Learning. https://evelynlearning.com/effective-pedagogical-practices/

Zeini, S., Göhnert, T., Hoppe, U., & Krempel, L. (2012). The impact of measurement time on subgroup detection in online communities. *Proceedings of the 2012 IEEE/ACM international conference on advances in social networks analysis and mining, ASONAM 2012*, 389–394. https://doi.org/10.1109/ASONAM.2012.70

Zimmerman, B. J. (1990). Self-regulated learning and academic achievement: An overview. *Educational Psychologist, 25*(1), 3–17. https://doi.org/10.1207/s15326985ep2501

Zimmerman, B. J., Bandura, A., & Martinez-Pons, M. (1992). Self-motivation for academic attainment: The role of self-efficacy beliefs and personal goal setting. *American Educational Research Journal, 29*(3), 663–676. https://doi.org/10.3102/00028312029003663