

# Asynchronous learning: a general review of best practices for the 21st century

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## Abstract

**Purpose** – The purpose of this paper is to create a “go-to-guide” of best practices in the creation of asynchronous courses. Due to the global pandemic, millions of students around the world transitioned from in-class instruction to online programs, which ranged from completely synchronous classrooms to completely asynchronous classrooms. Students were forced to learn how to engage within an online classroom environment with minimal notice and instructors were abruptly thrust into a different operational environment, with many required to construct educational ecosystems in an unfamiliar and digitized interface. This led to several actions and the utilization of a multitude of different teaching techniques, many of which were poorly implemented.



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**Design/methodology/approach** – Key words, “Asynchronous learning”, “Learning”, “Feedback”, “Online Instruction”, and “Classroom Design” were searched in online data bases (Google Scholar, PubMed, EBSCO and Data Base of Open Access Journals). These then were read by the authorial team and authoritative papers were selected by the team based on the frequency of utilization by other papers in the field and the utility of these papers for the design of asynchronous courses.

**Findings** – This paper explores asynchronous learning from the perspective of how instructional science and learning science can be applied to create the best classroom for both pupil and instructor.

**Originality/value** – It looks to provide a go-to-guide for best practices in asynchronous learning and the development of K-12 classrooms, graduate and medical school classrooms and finally continuous medical education classrooms. Finally, this guide looks to facilitate the development of master instructors through statements on how to properly provide feedback to students.

**Keywords** Sequential learning, Asynchronous learning, Desirable difficulties, Productive failure, Metacognition, Multimedia principles, Best practices

**Paper type** Literature review

During the first quarter of the 2020 calendar year, millions of primary school, secondary school, undergraduate and graduate students were transitioned from in-class instruction to online programs due to a global pandemic. Children as young as six years of age now were required to learn through video software services and other online technologies. These online classroom programs varied in regularity, ranging from completely synchronous classrooms where students continued to gather on fixed, predetermined schedules through video call programs such as Zoom®, to completely asynchronous classrooms, where students engaged with discussion boards and other forms of virtual learning. Because of this sudden thrust into the virtual classroom, many students and their instructors were forced to learn how to engage with class materials online with minimal notice. This paper looks to explore asynchronous learning in view of how instructional science and learning science can be applied to create the best classroom experience available for these students, especially with regards to K-12 education classrooms, college and graduate school classrooms, and continuous medical education (CME) classrooms.

In the current literature, there have been several comparisons between different learning modalities including hybrid, face-to-face, synchronous online courses and asynchronous online courses (Arbaugh, 2000; Branon and Essex, 2001; Choi and Hand, 2020; Mabrito, 2006; Nieuwoudt, 2020; Steele and Holbeck, 2018; Wang and Woo, 2007). However, much of this literature has focused on the ways that these different modalities differ in student learning experiences, rather than on potential ways to improve the student’s learning in these environments (Arbaugh, 2000; Branon and Essex, 2001; Lazarevic and Bentz, 2021; Mabrito, 2006; Wang and Woo, 2007). It is easy to ascertain from anecdotal evidence that regardless of the learning interface, a poorly designed classroom where instruction engagement is low will not foster learning as well as a classroom that is designed to facilitate learning (Scott-Webber, 2014). Therefore, this article aims to utilize the educational psychology literature to provide evidence-backed recommendations regarding the construction of an educational medium in an asynchronous learning environment. Through the dissemination of these best practices to instructors, it is hoped that the asynchronous classroom may be better calibrated to foster a more effective and student-oriented learning environment. The problem which this literature review looks to address is the current lack of guidance in the creation of high quality and high-fidelity asynchronous courses which can enable learning in the same manner as in person course. This article will focus on the below mentioned:

### Literature review

Following currently accepted standards of the writing of narrative reviews (Greenhalgh *et al.*, 2018; Akkihal *et al.*, 2022; Ghasemi *et al.*, 2020), the vast literature on educational practices

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were reviewed. Articles were procured utilizing the major online databases (Google Scholar, PubMed, EBSCO and DOAJ) and the key words, “Asynchronous learning”, “Learning”, “Feedback”, “Online Instruction” and “Classroom Design”. During the initial review roughly 155 search results were populated through search results with GoogleScholar, 156 with the National Library of Medicine (NLM or PubMed), 157 with EBSCO and 995 through the DOAJ. Each of these papers were then read by two independent researchers and those papers which were considered immediately to be authoritative papers based on the frequency of utilization by other papers in the field and the utility of these papers for the design of asynchronous courses were included. Those papers which were less authoritative were brought to the team and discussed – those considered to be important by consensus were also included as source materials for the writing of this general narrative review of the literature. After exclusion of duplicates and those papers which were considered to either not be directly applicable in the creation of asynchronous classrooms or were not possible to replicate in an asynchronous learning environment the remaining sum total of 52 peer reviewed papers.

### **Theory #1: spacing and interleaving**

The first major theory which demonstrates great promise in the asynchronous classroom is that of spacing and interleaving – also known as sequence learning. Sequence learning is one of the best-studied and most replicated learning strategies and theories to date (Versteeg *et al.*, 2020). There is strong evidence that suggests sequence learning is one of the most effective learning strategies available for both in-person education, personal education and asynchronous education (Firth, 2021; Li and Yang, 2020; Kim *et al.*, 2020; Badgaiyan *et al.*, 2007; Sisti *et al.*, 2007). Because of the numerous definitions at use with the field of education, sequence learning for this article is defined as the utilization of spaced learning episodes in time with breaks and the utilization of other learning experiences placed in-between these learning episodes – otherwise referred to as spacing and interleaving within the educational psychology literature (Ritter *et al.*, 2007). Cepeda *et al.* (2008) performed an internet-based study and illustrated that study time spacing had a measurable impact on study participants’ ability to recall and recognize material across test time intervals ranging from 0–105 days. With asynchronous learning, students can navigate the retention intervals (RIs), time between study and assessment that best suits their desired long-term learning outcomes while discovering which interval best optimizes their ability to retain information across time. Having demonstrated that RIs, spacing of study and testing, influence retention, Cepeda *et al.* (2008) concluded that “it appears no longer premature for psychologists to begin to offer some rough practical guidelines to people who wish to use study time in the most efficient way possible to promote long-term retention” (p. 1101). Sequence learning can be most optimally utilized in a classroom that has sufficient longitudinal reserve, as the very nature of sequence learning necessitates a sufficient passage of time.

### *Discussion forums*

Online discussion forums are one way in which institutions have embedded sequence learning in an asynchronous environment (Rovai, 2007). An example of this is when an instructor creates a discussion question that requires students to individually respond with a 250-word answer as a weekly assignment. On top of this response to the discussion question, the student must also respond to two classmates. The benefits of this design manifest in three primary forms. First, having three separate responses results in the student spending more time and likely delving deeper into the learning materials compared to a single response. Second, since the two peers are asynchronous to the student, and are instead following their own pace, their responses are likely posted on separate days. This difference is a space in time and is consequently a prime example of sequence leaving. Hattie and Timperley (2007) found

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further evidence in their educational review on feedback illustrating that delayed feedback related to a learner's process (ex. cognitive process of developing and articulating an idea) can positively benefit the learner. The spacing of the student feedback then acts as a peer level and instructor level, type of feedback which may further promote deeper effective learning utilizing a reflection on meta-cognitive processes. The other major benefit of this design is that unlike examinations, research papers, essays or other forms of assessments, the discussion question forum is a low stakes environment. This helps transition the focus of students from a performance-oriented mentality that discourages mistakes and errors, to one that facilitates a comfortable display of understanding or lack thereof, such that can be corrected if necessary. This works well with smaller classrooms of up to 100 students. Nevertheless, with larger classes as seen with large research institutions, this can be accomplished through requiring multiple subsections or another feature, such as graded problem sets, to be implemented.

#### *Sub-theory #1: desirable difficulties and productive failure*

The construction of open-ended forums and discussion questions encourages learners to display the flow of ideas that culminated in their conclusions. Students may also deliberate the internal and external material they used to establish the prerequisite knowledge pool needed to supply the foundational flow of logic demonstrating to peers, the instructor and themselves both understanding of the concepts of the materials and the process by which they garnered their end conclusion. These types of discussions are best suited for exercises where the primary objective is not necessarily in displaying a factually correct conclusion, but rather in fostering complex cognitive processes that hone one's critical thinking skills.

These discussion forums tap into the benefits espoused by the literature on desirable difficulties and productive failures (Wagner *et al.*, 2017), another theory which can be utilized well in conjunction with spacing and interleaving. The deliberately imposed process by which students struggle to gather a specialized knowledge fund that they use to construct a logical answer to a discussion question that is then besieged by peers or instructors, not only accentuates a student's knowledge retention capabilities on the topic, but also exposes them to multiple perspectives and flows of ideas. This process ultimately results in a more robust understanding of the application of this material within both the context of utility as well as its implications as a part of the larger body of knowledge (Persellin and Daniels, 2019). While the amount of work in monitoring the discussion question forum, responding to students and grading the discussion question interactions at the end of the session may seem as though it increases the workload on the teacher, the benefits for the student learning can simply not be overstated (Persellin and Daniels, 2019). This forces the student to re-engage with materials several days in a row, engaging their conscious minds with the theoretical benefits of sequence learning. Therefore, the authorial team recommends that this type of instructional tool be used as a part of asynchronous online learning.

#### *Spaced question sets*

One of the other strategies that can be utilized within the asynchronous classroom is spaced out question sets that consist of new and review material. Many online platforms offer the ability to assign homework problems for a class with specific due dates. Instructors may utilize this function by spacing the question sets so that they do not open until a few days before the assignments are due. Ideally, the questions vary in scope, with the bulk of questions necessitating the critical application of knowledge attained from prior material, some questions focused purely on review of previous material, and a specialized portion of questions that advance the frontiers of the cumulative knowledge pool. One frequently used setting is allowing the students unlimited attempts at the question set within the time frame

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of the assignment (a week or so), such that they may learn through trial-and-error and eventually get all the questions correct (Bjork and Bjork, 2020; Bjork *et al.*, 2015). The primary objective of this exercise is not an assessment of a student's understanding, but rather to augment their learning through providing example questions and example situations in which this knowledge may be tested on either an examination or in the real world. Through engaging with all the materials and having the ability to make errors without penalty, this ensures that the homework assignment is formative in the students understanding of the materials, provides real time feedback as to improve the student's learning, and engages the students actively in the learning process.

By using these spaced learning sets, students are actively participating in sequential learning. This simple format can and should be used in asynchronous mathematics, finance, science and accounting courses to help students maximally retain and obtain knowledge (Bjork and Bjork, 2020; Bjork *et al.*, 2015). For the different types of classrooms, with special attention to college, graduate school and CME courses, having small, interleaved question sets of as few as 5 multiple-choice questions to allow for the students to check their understanding of the materials, be corrected on misconceptions and prepare better for the final examination at the end of the module. By including spaced question sets where the students can make mistakes and have unlimited attempts at answering similar questions, the student's learning is comparably enhanced to that seen with the utilization of the discussion question boards (Bjork and Bjork, 2020; Bjork *et al.*, 2015).

#### *Formative assessments*

Both examples above may also be categorized within the educational psychology literature as formative assessments, where the goal is not to test the comprehensive knowledge that has been obtained like that seen with summative assessments. Instead, formative assessments are used to help students see the knowledge deficits early to learn better and more fully the materials and concepts. Placing formative, low-stakes assessments, in the early phases of discovering new material is key in ensuring that the student's understanding of the material is sound. If not, the student's knowledge may be appropriately calibrated before the course advances too far, and their misunderstanding prevents the logical incorporation of additional material (Shepard, 2000). Since the objective of this task is to generate constructive feedback during the learning phase, it must be low-stakes and designed such that a lack of understanding or misconception of the material is not penalized as heavily as would be on a final examination or benchmark paper. This type of assessment is often awarded a small number of points towards the overall final grade, if at all – depending on the situation in which it is used. Some ways that this has been implemented, on top of discussion question forums and homework problem sets, is through the utilization of rough drafts when the final summative assessment is a term or research paper, an exit ticket that the students fill out before leaving the classroom for the day, and/or through a pre and post-class quiz where students can check their understanding and the teacher can have a clear understanding of areas where much of the class is struggling (Wiliam, 2017; Wiliam, 2006). Through the proper utilization of these assignments, student learning is bolstered as the teacher can now focus on areas where the students are struggling with concepts the most – adapting to the needs of the students (Brookhart *et al.*, 2008). Much of the criticism on the utility of formative assessments focuses on inappropriate timing, such as when they are introduced at a stage where results are not used to adapt teaching style or resources offered to students, or to provide individualized guidance to stragglers (Bennett, 2011; Sadler, 1998). If inappropriately timed or designed, formative assessments may simply be an additional assessment burden for students to overcome. Therefore, when set so that the students have immediate or near immediate feedback, the students can improve their deficiencies in certain

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subjects providing a multifaceted approach to learning. When [Hattie and Timperley \(2007\)](#) explain feedback on task (FT), they further iterate how this type of immediate feedback response can better benefit the learner, resulting “in faster rates of acquisition” (p. 98) – these faster rates of acquisition are key for student learning in the fast-paced modern world.

This avoids the pitfall of only the instructor having a clear understanding of the class difficulties and allows for both the student and the instructor to modulate their behavior leading to a more individualized and stronger learning experience. Therefore, proper utilization can and will improve the student’s learning and overall educational experience ([Jain et al., 2012](#)).

### **Theory #2: metacognition in the asynchronous classroom**

The second major theory for use within the asynchronous learning environment is that of metacognition. Metacognition is a major educational psychology theory that has a great potential benefit for those involved in the asynchronous classroom; it focuses on one’s awareness of one’s own thought processes and steps taken to come to the current conclusions about the materials. Metacognition focuses on the ability of a person to see the learning that is occurring, create a proper evaluation of the learning occurring, and then make changes in the way that they are interacting with the materials so that they can increase their overall learning. In the face-to-face classroom and other less traditional learning situations, this is often measured through the writing of reflection papers focused on the efforts incurred in the learning process, lessons learned from the activity, and finally, what changes could be made to improve either the learning experience or the amount of material retained. As a practice, metacognitive reflective writing has been demonstrated to help the students overall both in helping them to determine what processes work well for them and help them to process emotional and other cognitive dimensions that were affected by the activities ([Tanner, 2012](#); [Desautel, 2009](#)). Since reflective writing, when focused on the processes of learning, can help a student recognize areas of strength and weakness and then take conscious steps to improve with the low number of required resources to utilize this particular tool, reflective writing can be used in any classroom setting – ranging from the primary school child to the advanced lecture for post-doctoral learners ([O’Loughlin and Griffith, 2020](#)). For CME courses, this practice of using reflective writing after clinical experiences, simulations, video lectures or other forms of learning episodes has been used in nursing and other fields and should continue to be included as a portion of the requirements to obtain credits within some of these asynchronous courses ([O’Loughlin and Griffith, 2020](#); [de Andrés Martínez, 2012](#); [Fonteyn and Cahill, 1998](#)).

#### *Exit tickets*

Another key strategy that can be utilized for tapping into metacognitive strategies with students who are interacting with the materials within an asynchronous course is the utilization of classroom exit tickets ([Fifer, 2019](#)). These can be placed at the end of a video lecture or recorded PowerPoint. In this method, the students write a few reflective sentences about the main points or takeaways that they received from the lesson that they just watched. While this might seem like a superfluous exercise, the effort required into summarizing a key point requires that the student not only had paid attention but also be able to quickly and succinctly find the areas of the lesson materials that they feel were important or pertinent to their learning or application. This concept of finding importance from an individual’s learning is also known as monitoring and is a key part of the metacognitive process ([Rivers, 2020](#)). As an individual continues to develop the skill of monitoring their learning, they are more likely to ask questions and perform research on their own time to fill in the gaps in their understanding of the materials presented or its application or space in their current body of knowledge ([Morphew, 2021](#)). Through utilizing exit tickets, students’ learning is bolstered, as

mentioned above with formative assessments, and the teacher can then individualize student guidance. In CME, these reflective exit tickets can be utilized in the same manner as with nonCME courses to help with the summarization of key principles for clinical practice. This exit ticket can also be questions that the students had during the video which can be answered by the professor or instructor during future lectures to address the questions that the students had without singling out the student. This provides a more open environment for the students to better understand the material while not fearing the spotlight being on them.

**Theory #3: multimedia principles**

One final concept that is key for online, asynchronous instruction is that of Mayer’s twelve multimedia principles (Detailed in Table 1). Originally proposed by Mayer in the 1990s (Mayer and Moreno, 1998), these twelve principles are considered to be the best practices for creating multimedia tools for learning (i.e. presentations, videos and other mixed media instructional tools which, by definition, contain both text, spoken or written, with graphics) (Mayer, 2008, 2014). These principles have been suggested for application within the online classroom (Mayer, 2017), with medical education (Grech, 2018), and can and should be utilized within CME course design (Issa et al., 2011, 2013). Through application of the Mayer’s 12 principles for multimedia design, the presentations, videos and other tools used in asynchronous online courses can both be streamlined. Through the process of streamlining this content, these presentations can be made to be more effective for teaching students and, with small conscious effort, be modified with the updated information to permit their continued utilization.

**Application in the K-12 classroom**

Within the kindergarten through 12th-grade classroom, the utilization of these asynchronous pieces can be utilized by teachers in the subjects of the arts and sciences. Wherein, the

The principle	What it means
Coherence Principle	Learning is improved when additional words, sounds and pictures (noise) are removed
Signaling Principle	Learning is improved when there are cues highlighted in the essential material
Redundancy Principle	Learning is improved when graphics and narration are utilized rather than utilizing graphics, narration and on-screen text
Spatial Contiguity Principle	Learning is improved when related words and pictures are presented near each other
Temporal Contiguity Principle	Learning is improved when related words and pictures are presented at the same time rather than one after the other
Segmenting Principle	Learning is improved when the material is presented in user-paced segments rather than as a singular and continuous unit
Pretraining Principle	Learning improved when students know the names and characteristics of the main teaching points or concepts
Modality Principle	Learning is improved with graphics and narration as compared to animation and on-screen text
Multimedia Principle	Learning is improved with both words and pictures rather than just words alone
Personalization Principle	Learning is improved when the teaching is written conversationally rather than formally
Voice Principle	Learning is improved when the narration is spoken with a human voice rather than with a mechanistic voice
Image Principle	Learning is not necessarily improved when the speaker’s image is added to the screen
<b>Note(s):</b> Adapted from Mayer and Moreno (1998)	

**Table 1.**  
Mary Meyer’s 12  
principles

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students before class can, for example, watch a primer video selected from such sources as Khan Academy®, The Magic School Bus®, MinuteEarth®, MinuteBody® or other age-appropriate video sources and then provide a short summary in written form or perform an activity virtually that again is age-appropriate. This allows the student the opportunity to demonstrate their learning from the prework, utilize metacognitive reflective writing or other metacognitive activities to demonstrate to themselves a need or lack of need for further instruction, and then finally, this allows the teacher a chance to provide feedback so that this along with other activities are formative assessments to ensure that the student has gained the appropriate learning. Through the utilization of this format the student learning is both improved and remedial actions can take place to ensure that those students who may struggle with the materials can be “brought up to speed” in a timely manner to ensure that they are learning at the same pace as their peers.

### **Application in the college, graduate studies, and medical school and classroom**

The trademark of asynchronous learning is that students are participating at different times. This could involve watching a series of prescribed videos and going through assigned reading assignments followed by a quiz or test. However, the best asynchronous learning environments as described earlier in the paper create a not only a thoughtful dialog between the student and the instructor, but also between the students themselves as peers.

It has been proposed that the most profound and robust learning occurs if lesson activities follow the learning cycle first proposed by Kolb (1985), and later expanded on by Zull (2002) whereas the cycle begins with a tangible experience such as a designated video to watch or reading material to go through. This would be followed by reflective observation by the student on what they have learned through the assigned materials and afterwards the student reflects on abstract conceptualization of the material learned. Finally, this process ends with active experimentation of the use of material learned and the experience of receiving feedback from their instructor and dialog with other students through small groups or forum discussions (Kolb, 1985; Zull, 2002).

### **Application in the continued medical education (CME) classroom**

As with the elementary school classroom, college classroom, graduate school classroom and medical school, CME programs can also utilize these principles for adult learning. CME programs are often offered in an asynchronous learning environment as many are constructed to be viable for credit for several years. Online CMEs have quickly become the norm since the advent of the Internet and as a result, these are often seen as some of the most egregious of offenders when it comes to poor design and development for learning and retention of their pearls of wisdom and utility for patient care and the treatment of disease (Lockyer *et al.*, 2006). When the material is being presented in a written format, it is very helpful to have “call out” boxes in the margin that highlight an important highlight of the reading material. Additionally, as suggested earlier in the paper, having “questions” interspersed within the reading also stimulates the reader (student) to think more deeply on the material presented and the most salient take away points. This can then be utilized with digital technologies like that of question sets with recorded patient dialog, digital figures, imaging studies and other diagnostics to help cement the key concepts for the learners.

#### *Neurology CMEs*

One of the key examples of how this can be utilized in the neurological sciences would be in the utilization of the continuum curriculum and other CME curriculum in online platforms. Through incorporating the readings with interspersed questions, the practitioners can



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modify their understanding and approach to the curriculum and review as necessary. The instant feedback can then allow for the practitioner to investigate where they have a fundamental misunderstanding and adapt their body of knowledge. For the completion of the CME credits there can be a final integrative examination, a summative assessment, which would provide an immersive experience for the practitioner, wherein recorded patient dialog, digital figures, imaging studies and other diagnostics (EKG, Electrocardiogram; EEG, Electroencephalogram; and/or EMG, Electromyography) can be utilized to help the practitioner in the diagnostics of the simulated patient in question. This would increase the utility of the CME course in not only utilizing the tools listed above, but also improve the learning of the students through providing useful real time feedback on the finer points of the history, physical, diagnostic tools and therapeutic actions taken. Examples of similar materials to this include the Oxford Medical Education 360-degree virtual simulations for running codes, the American Heart Association's online portion of their Basic Life Support (BLS) and Advanced Life Support (ALS) courses, and McGrawHill's and Elseviers Online Adaptive Learning Courses (Oxford Medical Education, 2017; American Heart Association, 2022a, b; Elsevier, 2021; McGraw Hill, 2022).

### Statement on feedback

In addition to the stated actions and suggestions of the team, it is key that a small statement on the given feedback for assessments and assignments be included. It is the strongest belief of the authorial team that feedback as a tool must be, by definition, clear and easily understandable to the reader; concise, with as few words as possible so as to ensure that the reader can easily digest what is being said; actionable, so as to allow for change in behavior within the learner; and, if at all possible within the moment, so as to prevent the formation of bad habitual behaviors. If feedback is not applied in this manner, the learner is likely to see the feedback as useless for growth, hard to understand or at worst, punitive instead of formative. It is for this reason, that the authors believe that statements such as "improve grammar", "read more", "review basic materials" and other forms of overly generalized feedback to be, at best, a poor attempt at providing key actionable items and incredibly detrimental to student motivation and learning at worst. Whenever possible, if there is no feedback for growth, the authorial team believes that it is best to follow the colloquial statement referred to in the classical Disney film *Bambi*, "If you can't say something nice, don't say nothing at all" (Algar *et al.*, 1942). In the case of the instructor writing the feedback, nice being defined as clear, concise, actionable and, if possible, within the moment. "Good verbal feedback leaves room for student choice in the improvement . . . the more your assessments begin to provide both you and students with valuable information, the less trauma will be involved." (Brookhart, 2004, p. 11).

### Research limitations

Because of the nature of a general or narrative literature review, this particular paper may not contain all the information or studies that might be of interest to researchers (Greenhalgh *et al.*, 2018). Unlike systematic reviews narrative literature reviews try to cover a much larger area of the literature and provide recommendations based on the themes demonstrated from a number of papers, instead of analyzing individual papers for their results and determining the themes for a few concepts. One of the other major limitations was only utilizing those databases which were immediately available to use by the researchers, other databases do exist and may contain other either equally or more substantive resources which may have changed the recommendations of the team. Finally, in lumping children from the ages of 5–18 together as a singular group, there may have been a number of very specific recommendations, based on age and development that occurs at that specific time in life, that have been glossed over.

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## Future directions

Some future directions for this particular topic involve the creation of a set of randomized control trials in which these methods are utilized or a placebo course is created in which these methods are not utilized to test by how much these methods work to improve student's learning. Further literature reviews including systematic and meta-analyses should be performed on the different granular topics that the team has written on to provide more clear and specific recommendations. One particular area of specific future research might be in seeing the effects that changes with continual medical education courses have on the pass rates of board examination when practitioners are required to retake boards at the ten-year mark or when resident physicians go to take their primary board examination.

## Conclusion

This paper sought to explore asynchronous learning in view of how instructional and learning science can be applied to create the best classroom available for students in an asynchronous learning environment. Through an exploration of the literature and examples of strategies that work well for students, the reader should now have a grasp on how these best practices can be applied in setting up an asynchronous learning environment for the learner. The topics covered included the use of the principles of spacing and interleaving and several specific examples of how that could be utilized, the principle of meta-cognition and one practical example of how it can be utilized, and the twelve multimedia principles and the importance of their utilization in the creation of resources. There was further discussion of some specific examples of how these could be utilized in different classrooms ranging from elementary age children, to college students, to medical and graduate school students and, finally, to adult practicing professionals with some specific examples for practicing physicians. Lastly, a clear statement on the importance of clear and concise feedback was given to ensure that instructors are providing the best quality feedback to students, which enables learning and changed behaviors. Through implementing these practices, not only will student learning be bolstered, but the experiences of both the teacher and the student will be more positive due to the increased effectiveness of the teacher's instruction and time spent in teaching.

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