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Understanding Annual Updates to ICD 10 CM Codes Navigating CPT Code Changes for Surgical Procedures The Role of HCPCS Codes in Medical Billing Transitioning from ICD 9 to ICD 10 Challenges Specialty Specific Coding in Oncology Practices How to Avoid Errors in Evaluation and Management Coding Updates to Infectious Disease Coding Guidelines Best Practices for Using Modifiers in Medical Billing Impact of Coding Changes on Reimbursement Rates Training Resources for Mastering ICD 10 CM Coding for Chronic Conditions in Primary Care Future Trends in Medical Coding Systems
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Understanding the role of medical coding in healthcare compliance is pivotal, especially when managing whistleblower risks in medical practices. Specialized staffing ensures proper placement in roles such as nurses, physicians, and therapists **medical assistant staffing agencies** cash flow statement. Medical coding serves as a critical bridge between the clinical and financial domains of healthcare, translating intricate medical information into standardized codes that facilitate billing and regulatory reporting. This process ensures that healthcare providers are compliant with federal regulations, such as those mandated by the Health Insurance Portability and Accountability Act (HIPAA) or the Centers for Medicare & Medicaid Services (CMS). Compliance with these regulations is not just about adhering to legal requirements; it significantly impacts the operational integrity and ethical standing of medical practices.

In an era where whistleblowers have become increasingly vigilant about exposing fraudulent activities within healthcare institutions, understanding and implementing accurate medical coding practices emerges as a frontline defense. Whistleblowers often bring attention to discrepancies or unethical practices within organizations, sometimes resulting in significant legal repercussions for those involved. One significant area where issues can arise is through improper billing-whether intentional or due to errors-stemming from inaccurate coding.

Therefore, ensuring precise and compliant medical coding can mitigate these risks by fostering transparency and accountability within the practice. When codes accurately reflect the services provided, there is less room for misinterpretation or allegations of fraud. In addition, comprehensive training programs for staff involved in coding processes are essential. These programs should emphasize not only technical skills but also ethical considerations surrounding accurate documentation and billing.

Moreover, implementing robust auditing systems further strengthens compliance efforts by regularly assessing coding accuracy and addressing potential discrepancies before they escalate into major compliance issues. By proactively managing these risks through diligent oversight of medical coding practices, healthcare organizations can build a culture of integrity that aligns with both legal standards and ethical expectations.

Ultimately, understanding the role of medical coding in healthcare compliance serves as a foundational strategy in minimizing whistleblower risks. It helps establish trust not only with regulators but also with patients who rely on transparent and fair billing practices. As such, it represents an indispensable component of effective risk management strategies within any conscientious medical practice aiming to uphold its reputation while safeguarding against potential legal challenges.

Overview of the Update Process for ICD-10-CM Codes

- Importance of Annual Updates in Medical Coding
- Overview of the Update Process for ICD-10-CM Codes
- Key Changes and Additions to the Latest ICD-10-CM Code Set
- Impact of Updates on Healthcare Providers and Coders
- Strategies for Staying Informed About Code Changes
- Challenges and Solutions in Adapting to New Codes

In the intricate world of healthcare, medical coding serves as a crucial bridge between complex medical procedures and their corresponding financial transactions. While this system is essential for efficient billing and insurance claims, it also opens the door to potential misconduct. Whistleblower allegations related to medical coding have become increasingly common, highlighting significant risks that medical practices must manage with vigilance.

One of the most prevalent whistleblower allegations is upcoding. This involves assigning a billing code that reflects a more severe diagnosis or more intensive procedure than what was actually provided. Such actions can lead to inflated reimbursements from insurance companies, including Medicare and Medicaid. Upcoding not only violates ethical standards but also breaches legal obligations under the False Claims Act (FCA). Whistleblowers, often employees within the practice who are privy to these discrepancies, play a vital role in bringing such issues to light.

Another common allegation pertains to unbundling, where services that should be billed together are separated out into individual codes to increase total reimbursement. This deceptive practice misrepresents the nature of care provided and overcharges insurers and patients alike. Whistleblowers help uncover these schemes by identifying patterns in billing that deviate from standard practices. Their insights are invaluable in rectifying systemic abuses within medical practices.

Duplicate billing is yet another area rife with whistleblower activity. Whether intentional or accidental, submitting multiple claims for a single service can result in substantial financial gain at the expense of patients and insurers. Whistleblowers often possess insider knowledge about these repeated submissions and provide crucial testimony needed for investigations.

The environment within which whistleblowers operate is critical for fostering transparency and accountability. Medical practices must cultivate an atmosphere where individuals feel safe reporting unethical behavior without fear of retaliation. Implementing comprehensive training programs on compliance and ethics can empower employees with knowledge about proper coding procedures and encourage them to speak up when they notice irregularities.

Moreover, establishing clear channels for reporting suspected fraud internally can prevent escalation to external authorities or legal battles that could damage reputations irreparably. Practices should invest in regular audits conducted by independent bodies to ensure accuracy in coding processes and identify areas susceptible to fraud or error before they become liabilities.

In conclusion, managing whistleblower risks related to medical coding requires proactive measures focused on education, transparency, and ethical integrity within medical practices. By understanding the common allegations—such as upcoding, unbundling, and duplicate billing—and creating robust frameworks for internal oversight, healthcare providers can mitigate risk while maintaining trust with both their staff members and those they serve. Embracing these strategies not only enhances operational efficiency but also fortifies the moral compass guiding the industry toward responsible care delivery.

Key Changes and Additions to the Latest ICD-10-CM Code Set

In the healthcare industry, where patient safety and ethical standards are paramount, whistleblowers play a crucial role in exposing malpractices and ensuring accountability. Legal frameworks and protections for these individuals are essential to foster an environment where wrongdoing can be reported without fear of retaliation. Managing whistleblower risks in medical practices requires a comprehensive understanding of these legal protections and the

implications they have for both employees and employers within the sector.

Whistleblowers in healthcare are often motivated by concerns for patient welfare and the integrity of medical practices. However, despite their noble intentions, they frequently face significant risks including professional ostracization, harassment, or even termination. Recognizing these challenges, various countries have implemented legal frameworks specifically designed to protect whistleblowers from retaliation. In the United States, for example, laws such as the Whistleblower Protection Act and provisions under the False Claims Act offer significant safeguards. These laws not only provide protection but also incentivize reporting by offering financial rewards to those who expose fraud against government programs like Medicare and Medicaid.

Similarly, European nations adhere to directives that mandate strong protections for whistleblowers across all sectors, including healthcare. The EU Whistleblower Directive requires member states to establish secure channels for reporting misconduct and ensures that individuals who report breaches are protected from adverse actions. This directive encourages transparency and accountability while promoting a culture where ethical concerns can be addressed openly.

For medical practices seeking to manage whistleblower risks effectively, it is imperative to cultivate an organizational culture that prioritizes openness and ethical behavior. This involves implementing internal policies that align with legal requirements while fostering trust among staff members. Establishing clear procedures for reporting concerns internally can serve as a first line of defense against potential external disclosures that could damage reputations or result in legal consequences.

Training programs aimed at educating employees about their rights as well as responsibilities concerning whistleblowing should be integrated into regular compliance training sessions. This ensures that staff members are aware of how to report unethical behavior safely and understand the mechanisms available for their protection.

Moreover, leadership within medical practices must demonstrate a commitment to addressing issues raised by whistleblowers promptly and thoroughly. By taking allegations seriously and conducting investigations with integrity, organizations can reinforce their commitment to maintaining high ethical standards while protecting patients' best interests.

Managing whistleblower risks also entails providing support systems such as counseling services or legal advice for those considering coming forward with information about misconduct or malpractice. Such resources not only assist potential whistleblowers but also signal an organization's dedication to safeguarding its workforce from undue harm.

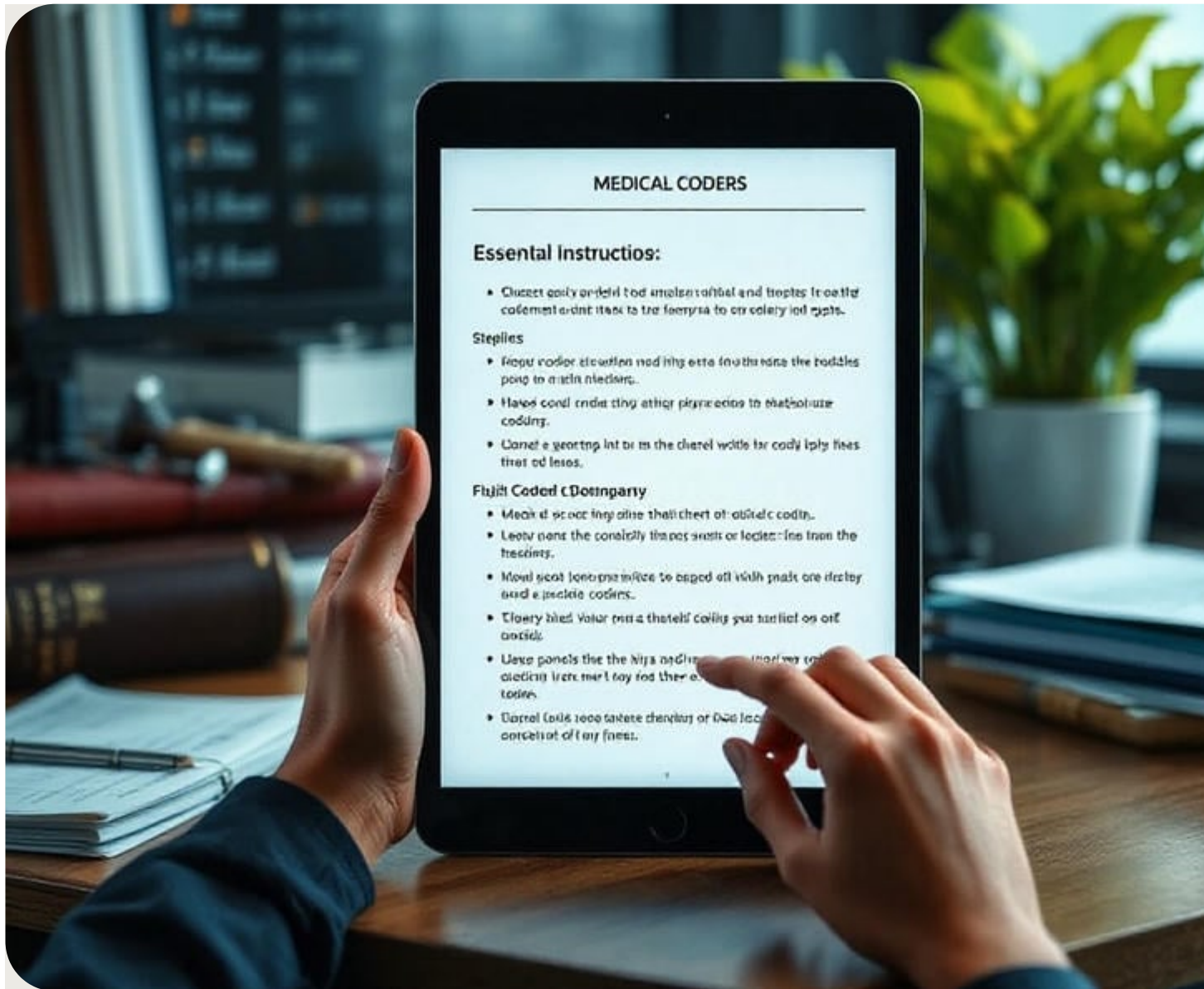
In conclusion, creating an environment conducive to responsible whistleblowing within healthcare settings is vital for upholding quality care standards and protecting patients' rights. Legal frameworks offer essential protections; however, it is ultimately up to individual medical practices themselves-through proactive risk management strategies-to ensure these measures translate into real-world safety nets capable of defending both courageous individuals bringing issues forward-and ultimately-the public good they seek so diligently protect against harm's way through exposure maleficence hidden behind closed doors until brought light brave voices willing take stand when necessary most desperately needed indeed!

**Procedure Codes
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BILLING

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	Meditions	Flolon	\$5,000
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Cocler	67,280.80	Flolon	9,000.000
Foriete	2,000,000	Flolon	101,000
Adjustr	61,000,000	Flolon	6,000
Tedreer	50,000.00	Flolon	30,000
Llepte	\$9,133,000	Flolon	30,000
Proble: Halle		Flolon	400
Leatz:comodiss		Flolon	1,000
Instipstionis		Flolon	1,000
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Impact of Updates on Healthcare Providers and Coders

Managing whistleblower risks in medical practices is an increasingly significant concern for healthcare administrators and practitioners. Whistleblowers play a crucial role in maintaining ethical standards and ensuring compliance with legal and regulatory requirements. However, they also pose potential risks to the reputation and financial stability of medical practices if allegations lead to investigations or penalties. One effective strategy to mitigate these risks involves ensuring accurate medical coding, as it directly impacts billing processes, patient care documentation, and overall compliance.

Accurate medical coding serves as the backbone of reliable healthcare administration. It ensures that services provided are precisely documented and billed, thereby reducing errors that can attract scrutiny from regulators or spark whistleblower actions. Inaccurate coding can lead to claims of fraudulent billing practices, which are common triggers for whistleblower reports under the False Claims Act. By prioritizing accuracy in this area, medical practices can significantly diminish the likelihood of such claims.

Training is a critical component in achieving high standards of accuracy in medical coding. Healthcare providers should invest in regular training sessions for their coding staff to keep them updated on changes in coding systems like ICD-10, CPT, and HCPCS. This continuous education helps coders understand nuances and complexities associated with different codes, thus minimizing errors. Furthermore, incorporating comprehensive training programs creates a culture of accuracy and accountability within the organization.

Implementing robust auditing systems is another essential strategy for mitigating whistleblower risks through accurate medical coding. Regular audits help identify discrepancies or patterns that may indicate improper billing practices before they become systemic issues that could be reported by insiders. External audits provide an additional layer of scrutiny by bringing an objective perspective to the practice's operations and ensuring adherence to best practices.

Technology can also play a pivotal role in enhancing accuracy in medical coding. Automated solutions like natural language processing (NLP) tools can assist coders by suggesting appropriate codes based on clinical documentation inputs. These technologies not only streamline workflows but also reduce human error, further safeguarding the practice against potential whistleblower incidents related to incorrect billing.

Additionally, fostering an open environment where employees feel comfortable raising concerns internally is vital for managing whistleblower risks effectively. Encouraging internal reporting allows organizations to address issues proactively rather than facing external complaints later on. Establishing clear channels for communication and ensuring employees

understand how their reports will be handled confidentially instills trust within the workforce.

In conclusion, accurate medical coding emerges as a fundamental strategy for mitigating whistleblower risks in medical practices. Through targeted training programs, diligent auditing processes, embracing technology innovations, and promoting open communication channels within organizations-healthcare providers can protect themselves against potential allegations while upholding integrity and quality care standards. By focusing on these strategies collectively-medical practices not only safeguard their operations but also contribute positively towards building a trustworthy healthcare system where patient welfare remains paramount.

Strategies for Staying Informed About Code Changes

In the realm of healthcare, where patient welfare and trust form the cornerstone of practice, maintaining compliance and ethical standards is paramount. Medical coders, often situated at the intersection of clinical care and administrative oversight, play a critical role in ensuring that medical practices adhere to legal and ethical standards. Consequently, training and education programs for medical coders on compliance and ethics are essential in safeguarding healthcare integrity. Among these educational imperatives is managing whistleblower risks-a topic that demands careful attention.

Whistleblowers have historically served as vital sentinels in uncovering unethical or illegal activities within organizations. In medical practices, where billing inaccuracies or fraudulent claims can lead to significant legal repercussions and damage to patient trust, the role of whistleblowers becomes even more crucial. However, addressing whistleblower risks requires a nuanced approach-one that balances encouraging transparency while protecting individuals from retaliation.

Training programs aimed at managing whistleblower risks should start with fostering a culture of openness within medical practices. Coders must understand that their duty to report discrepancies is both a professional obligation and an ethical responsibility. Educational

initiatives can demystify the process by which concerns are raised, emphasizing confidentiality protections and outlining clear reporting channels.

Moreover, it's important for training programs to address the psychological barriers faced by potential whistleblowers. Fear of retaliation or career repercussions often silences individuals who might otherwise report misconduct. By incorporating modules on anti-retaliation policies and legal protections afforded to whistleblowers under laws such as the False Claims Act, educational programs can empower coders with knowledge about their rights.

Interactive case studies can be an effective tool in these training sessions, allowing coders to engage with real-life scenarios where ethical dilemmas arise. Such exercises can illuminate the complexities involved in reporting issues while reinforcing problem-solving skills needed to navigate these situations effectively.

Furthermore, continuous education on evolving regulations ensures that medical coders remain vigilant and informed about current compliance standards. This ongoing learning process helps maintain high ethical standards across all levels of operation within medical practices.

Ultimately, successful management of whistleblower risks hinges on creating an environment where honesty is not only expected but also protected. Medical coding professionals armed with thorough understanding from well-structured training programs become invaluable assets in upholding compliance and ethics within healthcare settings.

As we advance into an era increasingly defined by regulatory scrutiny and heightened public awareness, investing in comprehensive education for medical coders serves as both a safeguard against risk and a commitment to excellence in patient care. Through diligent management of whistleblower risks-grounded in robust training-medical practices can continue to foster trustworthiness essential for their success and sustainability.

Challenges and Solutions in Adapting to New Codes

In today's rapidly evolving healthcare environment, the integrity and ethical standards of medical practices are paramount. With increasing scrutiny from regulatory bodies and heightened public awareness, managing whistleblower risks has become an essential aspect of maintaining trust within medical institutions. Central to this effort is the implementation of robust internal reporting mechanisms and fostering a culture of transparency.

Implementing effective internal reporting systems is crucial in providing a structured pathway for employees to report unethical or illegal activities without fear of retaliation. These mechanisms serve as the first line of defense against potential malpractice or misconduct that could not only jeopardize patient safety but also expose the practice to legal liabilities and reputational damage. A well-designed reporting system should be accessible, anonymous if necessary, and clearly communicated to all members of the organization. It should provide multiple channels for reporting, such as hotlines, suggestion boxes, or digital platforms, ensuring that employees feel safe and supported when voicing their concerns.

However, simply having a system in place is not sufficient. The success of these mechanisms largely depends on the organizational culture surrounding them. Encouraging a culture of transparency requires leaders in medical practices to model openness and honesty in their communication and decision-making processes. This involves actively soliciting feedback from staff, addressing reported issues promptly and fairly, and demonstrating accountability at all levels of leadership.

Transparency fosters trust among employees by assuring them that their concerns are taken seriously and will be addressed appropriately. When staff members observe that issues raised through internal channels are met with positive action rather than punitive measures or indifference, they are more likely to engage with these systems proactively. This openness

can lead to early detection and resolution of problems before they escalate into more significant crises.

Moreover, cultivating transparency extends beyond responding to whistleblower reports; it involves integrating ethical considerations into every facet of operations. Medical practices should ensure that policies regarding confidentiality, conflicts of interest, patient care standards, and compliance with regulations are consistently applied and communicated across the board.

Training programs play a pivotal role in reinforcing this culture by educating staff about their rights as whistleblowers under laws like the False Claims Act or HIPAA regulations while emphasizing their responsibility towards upholding ethical standards. Continuous professional development opportunities can equip employees with the skills needed to recognize potential risks effectively.

Ultimately, managing whistleblower risks through internal reporting mechanisms coupled with a transparent organizational culture empowers healthcare professionals to act as stewards of integrity within their practice. By prioritizing these values, medical institutions not only safeguard themselves against legal repercussions but also enhance their reputation as trustworthy providers dedicated to delivering high-quality patient care.

In conclusion, embedding transparency into the fabric of medical practices is an ongoing commitment requiring vigilance from leadership down through every level of operation. As we continue navigating complex healthcare landscapes marked by rapid technological advances and shifting regulatory frameworks-embracing open dialogue around ethics remains integral for sustaining both institutional credibility and optimal patient outcomes.

About financial statement analysis

Not to be confused with Financial analysis.

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Part of a series on

Accounting

Early 19th-century German ledger

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- Constant purchasing power
- Historical cost
- Management
- Tax

Major types

- Audit
- Budget
- Cost
- Forensic
- Financial
- Fund
- Governmental
- Management
- Social
- Tax

Key concepts

- Accounting period
- Accrual
- Constant purchasing power
- Economic entity
- Fair value
- Going concern
- Historical cost
- Matching principle
- Materiality
- Revenue recognition
- Unit of account

Selected accounts

- Assets
- Cash
- Cost of goods sold
- Depreciation / Amortization (business)
- Equity
- Expenses
- Goodwill
- Liabilities
- Profit
- Revenue

Accounting standards

- Generally-accepted principles
- Generally-accepted auditing standards
- Convergence
- International Financial Reporting Standards
- International Standards on Auditing
- Management Accounting Principles

Financial statements

- Annual report
- Balance sheet
- Cash-flow
- Equity
- Income
- Management discussion
- Notes to the financial statements

Bookkeeping

- Bank reconciliation
- Debits and credits
- Double-entry system
- FIFO and LIFO
- Journal
- Ledger / General ledger
- Trial balance

Auditing

- Financial
- Internal
- Firms
- Report
- Sarbanes–Oxley Act

People and organizations

- Accountants
- Accounting organizations
- Luca Pacioli

Development

- History
- Research
- Positive accounting
- Sarbanes–Oxley Act

Misconduct

- Creative
- Earnings management
- Error account
- Hollywood
- Off-balance-sheet
- Two sets of books

Financial statement analysis (or just **financial analysis**) is the process of reviewing and analyzing a company's financial statements to make better economic decisions to earn income in future. These statements include the income statement, balance sheet, statement of cash flows, notes to accounts and a statement of changes in equity (if applicable). Financial statement analysis is a method or process involving specific techniques for evaluating risks, performance, valuation, financial health, and future prospects of an organization.^[1]

It is used by a variety of stakeholders, such as credit and equity investors, the government, the public, and decision-makers within the organization. These stakeholders have different interests and apply a variety of different techniques to meet their needs. For example, equity investors are interested in the long-term earnings power of the organization and perhaps the sustainability and growth of dividend payments. Creditors want to ensure the interest and principal is paid on the organizations debt securities (e.g., bonds) when due.

Common methods of financial statement analysis include horizontal and vertical analysis and the use of financial ratios. Historical information combined with a series of assumptions and adjustments to the financial information may be used to project future performance. The Chartered Financial Analyst designation is available for professional financial analysts.

History

[edit]

Benjamin Graham and David Dodd first published their influential book "Security Analysis" in 1934.^[2] ^[3] A central premise of their book is that the market's pricing mechanism for financial securities such as stocks and bonds is based upon faulty and irrational analytical processes performed by many market participants. This results in the market price of a security only occasionally coinciding with the intrinsic value around which the price tends to fluctuate.^[4] Investor Warren Buffett is a well-known supporter of Graham and Dodd's philosophy.

The Graham and Dodd approach is referred to as Fundamental analysis and includes: 1) Economic analysis; 2) Industry analysis; and 3) Company analysis. The latter is the primary realm of financial statement analysis. On the basis of these three analyses the intrinsic value of the security is determined.^[4]

Horizontal and vertical analysis

[edit]

Horizontal analysis compares financial information over time, typically from past quarters or years. Horizontal analysis is performed by comparing financial data from a past statement, such as the income statement. When comparing this past information one will want to look for variations such as higher or lower earnings.^[5]

Vertical analysis is a percentage analysis of financial statements. Each line item listed in the financial statement is listed as the percentage of another line item. For example, on an income statement each line item will be listed as a percentage of gross sales. This technique is also referred to as normalization^[6] or common-sizing.^[5]

Financial ratio analysis

[edit]

Main article: Financial ratio

Financial ratios are very powerful tools to perform some quick analysis of financial statements. There are four main categories of ratios: liquidity ratios, profitability ratios, activity ratios and leverage ratios. These are typically analyzed over time and across competitors in an industry.

- *Liquidity ratios* are used to determine how quickly a company can turn its assets into cash if it experiences financial difficulties or bankruptcy. It essentially is a measure of a company's ability to remain in business. A few common liquidity ratios are the current ratio and the liquidity index. The current ratio is current assets/current liabilities and measures how much liquidity is available to pay for liabilities. The liquidity index shows how quickly a company can turn assets into cash and is calculated by: $(\text{Trade receivables} \times \text{Days to liquidate}) + (\text{Inventory} \times \text{Days to liquidate}) / \text{Trade Receivables} + \text{Inventory}$.
- *Profitability ratios* are ratios that demonstrate how profitable a company is. A few popular profitability ratios are the breakeven point and gross profit ratio. The breakeven point calculates how much cash a company must generate to break even with their start up costs. The gross profit ratio is equal to gross profit/revenue. This ratio shows a quick snapshot of expected revenue.
- *Activity ratios* are meant to show how well management is managing the company's resources. Two common activity ratios are accounts payable turnover and accounts

receivable turnover. These ratios demonstrate how long it takes for a company to pay off its accounts payable and how long it takes for a company to receive payments, respectively.

- *Leverage ratios* depict how much a company relies upon its debt to fund operations. A very common leverage ratio used for financial statement analysis is the debt-to-equity ratio. This ratio shows the extent to which management is willing to use debt in order to fund operations. This ratio is calculated as: $(\text{Long-term debt} + \text{Short-term debt} + \text{Leases}) / \text{Equity}$.^[7]

DuPont analysis uses several financial ratios that multiplied together equal return on equity, a measure of how much income the firm earns divided by the amount of funds invested (equity).

A Dividend discount model (DDM) may also be used to value a company's stock price based on the theory that its stock is worth the sum of all of its future dividend payments, discounted back to their present value.^[8] In other words, it is used to value stocks based on the net present value of the future dividends.

Financial statement analyses are typically performed in spreadsheet software — or specialized accounting software — and summarized in a variety of formats.

Recasting financial statements

[edit]

An earnings recast is the act of amending and re-releasing a previously released earnings statement, with specified intent.^[9]

Investors need to understand the ability of the company to generate profit. This, together with its rate of profit growth, relative to the amount of capital deployed and various other financial ratios, forms an important part of their analysis of the value of the company. Analysts may modify ("recast") the financial statements by adjusting the underlying assumptions to aid in this computation. For example, operating leases (treated like a rental transaction) may be recast as capital leases (indicating ownership), adding assets and liabilities to the balance sheet. This affects the financial statement ratios.^[10]

Recasting is also known as normalizing accounts.^[11]

Certifications

[edit]

Financial analysts typically have finance and accounting education at the undergraduate or graduate level. Persons may earn the Chartered Financial Analyst (CFA) designation through a series of challenging examinations. Upon completion of the three-part exam,

CFAs are considered experts in areas like fundamentals of investing, the valuation of assets, portfolio management, and wealth planning.

See also

[edit]

- Business valuation
- Financial audit
- Financial statement
- DuPont analysis
- Data analysis

References

[edit]

1. [^] *White, Gerald I.; Sondhi, Ashwinpaul; Fried, Dov (1998). The Analysis and Use of Financial Statements. John Wiley & Sons, Inc. ISBN 0-471-11186-4.*
2. [^] New York Times, August 16, 1998 Gretchen Morgenson – Market Watch MARKET WATCH; A Time To Value Words of Wisdom“ ... *Security Analysis* by Benjamin Graham and David Dodd, the 1934 bible for value investors.”
3. [^] New York Times, January 2, 2000 Business Section Humbling Lessons From Parties Past By BURTON G. MALKIEL “BENJAMIN GRAHAM, co-author of "Security Analysis," the 1934 bible of value investing, long ago put his finger on the most dangerous words in an investor's vocabulary: "This time is different." Burton G. Malkiel is an economics professor at Princeton University and the author of "A Random Walk Down Wall Street" (W.W. Norton).
4. [^] **a b** *Dodd, David; Graham, Benjamin (1998). Security Analysis. John Wiley & Sons, Inc. ISBN 0-07-013235-6.*
5. [^] **a b** "Accountingtools.com - Financial Statement Analysis". Archived from the original on 2014-08-11. Retrieved 2014-08-01.
6. [^] Perceptual Edge-Jonathan Koomey-Best practices for understanding quantitative data-February 14, 2006
7. [^] *Investopedia Staff (2010-08-12). "Financial Statement Analysis". Investopedia. Retrieved 2018-07-14.*
8. [^] *McClure, Ben (2004-04-12). "Digging Into The Dividend Discount Model". Investopedia. Retrieved 2018-07-14.*
9. [^] "Earnings Recast".
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11. [^] *Schenck, Barbara Findlay; Davies, John (3 November 2008). Selling Your Business For Dummies. ISBN 9780470381892.*

External links

[edit]

- Investopedia
- Beginner's Guide to Financial Statements by SEC.gov

Associations

[edit]

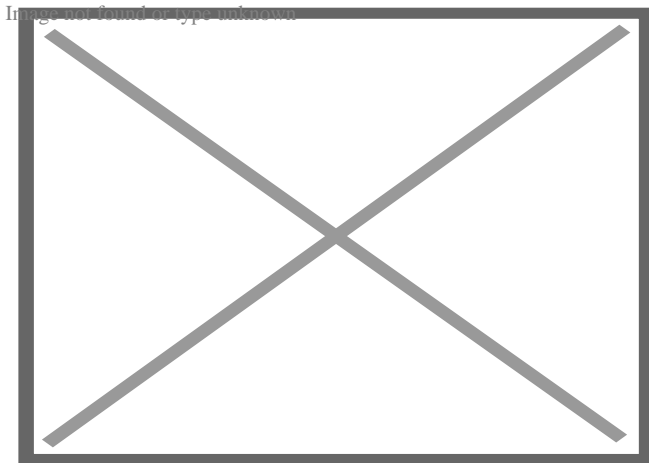
- SFAF - French Society of Financial Analysts
- ACIIA - Association of Certified International Investment Analysts
- EFFAS - European Federation of Financial Analysts Societies

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About learning

For the album by Perfume Genius, see *Learning* (album).

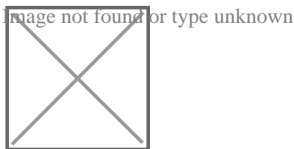
Several terms redirect here. For other uses, see Learn (disambiguation), Learned (disambiguation), and Learners (film).



American students learning how to make and roll sushi

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Cognitive psychology



Perception

- Visual
- Object recognition
- Face recognition
- Pattern recognition

Attention

Memory

- Aging
- Emotional
- Learning
- Long-term

Metacognition

Language

Metalanguage

Thinking

- Cognition
- Concept
- Reasoning
- Decision making
- Problem solving

Numerical cognition

- Numerosity adaptation effect
- Approximate number system
- Parallel individuation system

Learning is the process of acquiring new understanding, knowledge, behaviors, skills, values, attitudes, and preferences.^[1] The ability to learn is possessed by humans, non-human animals, and some machines; there is also evidence for some kind of learning in certain plants.^[2] Some learning is immediate, induced by a single event (e.g. being burned by a hot stove), but much skill and knowledge accumulate from repeated experiences.^[3] The changes induced by learning often last a lifetime, and it is hard to distinguish learned material that seems to be "lost" from that which cannot be retrieved.^[4]

Human learning starts at birth (it might even start before^[5]) and continues until death as a consequence of ongoing interactions between people and their environment. The nature and processes involved in learning are studied in many established fields (including educational psychology, neuropsychology, experimental psychology, cognitive sciences, and pedagogy), as well as emerging fields of knowledge (e.g. with a shared interest in the topic of learning from safety events such as incidents/accidents,^[6] or in collaborative learning health systems^[7]). Research in such fields has led to the identification of various sorts of learning. For example, learning may occur as a result of habituation, or classical conditioning, operant conditioning or as a result of more complex activities such as play,

seen only in relatively intelligent animals.^[8]^[9] Learning may occur consciously or without conscious awareness. Learning that an aversive event cannot be avoided or escaped may result in a condition called learned helplessness.^[10] There is evidence for human behavioral learning prenatally, in which habituation has been observed as early as 32 weeks into gestation, indicating that the central nervous system is sufficiently developed and primed for learning and memory to occur very early on in development.^[11]

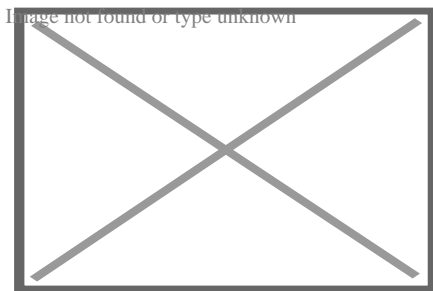
Play has been approached by several theorists as a form of learning. Children experiment with the world, learn the rules, and learn to interact through play. Lev Vygotsky agrees that play is pivotal for children's development, since they make meaning of their environment through playing educational games. For Vygotsky, however, play is the first form of learning language and communication, and the stage where a child begins to understand rules and symbols.^[12] This has led to a view that learning in organisms is always related to semiosis,^[13] and is often associated with representational systems/activity.^[14]

Types

[edit]

See also: Learning styles and Machine learning § Types of problems and tasks

There are various functional categorizations of memory which have developed. Some memory researchers distinguish memory based on the relationship between the stimuli involved (associative vs non-associative) or based to whether the content can be communicated through language (declarative/explicit vs procedural/implicit). Some of these categories can, in turn, be parsed into sub-types. For instance, declarative memory comprises both episodic and semantic memory.



Children learn to bike in the eighties in Czechoslovakia.

Non-associative learning

[edit]

Non-associative learning refers to "a relatively permanent change in the strength of response to a single stimulus due to repeated exposure to that stimulus."^[15] This definition exempts the changes caused by sensory adaptation, fatigue, or injury.^[16]

Non-associative learning can be divided into habituation and sensitization.

Habituation

[edit]

Main article: Habituation

Habituation is an example of non-associative learning in which one or more components of an innate response (e.g., response probability, response duration) to a stimulus diminishes when the stimulus is repeated. Thus, habituation must be distinguished from extinction, which is an associative process. In operant extinction, for example, a response declines because it is no longer followed by a reward. An example of habituation can be seen in small song birds—if a stuffed owl (or similar predator) is put into the cage, the birds initially react to it as though it were a real predator. Soon the birds react less, showing habituation. If another stuffed owl is introduced (or the same one removed and re-introduced), the birds react to it again as though it were a predator, demonstrating that it is only a very specific stimulus that is habituated to (namely, one particular unmoving owl in one place). The habituation process is faster for stimuli that occur at a high rather than for stimuli that occur at a low rate as well as for the weak and strong stimuli, respectively.^[17] Habituation has been shown in essentially every species of animal, as well as the sensitive plant *Mimosa pudica*^[18] and the large protozoan *Stentor coeruleus*.^[19] This concept acts in direct opposition to sensitization.^[17]

Sensitization

[edit]

Main article: Sensitization

Sensitization is an example of non-associative learning in which the progressive amplification of a response follows repeated administrations of a stimulus.^[20] This is based on the notion that a defensive reflex to a stimulus such as withdrawal or escape becomes stronger after the exposure to a different harmful or threatening stimulus.^[21] An everyday example of this mechanism is the repeated tonic stimulation of peripheral nerves that occurs if a person rubs their arm continuously. After a while, this stimulation creates a warm sensation that can eventually turn painful. This pain results from a progressively amplified synaptic response of the peripheral nerves. This sends a warning that the stimulation is harmful.^[22] ^[clarification needed] Sensitization is thought to underlie both adaptive as well as maladaptive learning processes in the organism.^[23] ^[citation needed]

Active learning

[edit]

Main article: Active learning

Active learning occurs when a person takes control of his/her learning experience. Since understanding information is the key aspect of learning, it is important for learners to recognize what they understand and what they do not. By doing so, they can monitor their own mastery of subjects. Active learning encourages learners to have an internal dialogue in which they verbalize understandings. This and other meta-cognitive strategies can be taught to a child over time. Studies within metacognition have proven the value in active learning, claiming that the learning is usually at a stronger level as a result.^[24] In addition, learners have more incentive to learn when they have control over not only how they learn but also what they learn.^[25] Active learning is a key characteristic of student-centered learning. Conversely, passive learning and direct instruction are characteristics of teacher-centered learning (or traditional education).

Associative learning

[edit]

Associative learning is the process by which a person or animal learns an association between two stimuli or events.^[26] In classical conditioning, a previously neutral stimulus is repeatedly paired with a reflex-eliciting stimulus until eventually the neutral stimulus elicits a response on its own. In operant conditioning, a behavior that is reinforced or punished in the presence of a stimulus becomes more or less likely to occur in the presence of that stimulus.

Operant conditioning

[edit]

Main article: Operant conditioning

Operant conditioning is a way in which behavior can be shaped or modified according to the desires of the trainer or head individual. Operant conditioning uses the thought that living things seek pleasure and avoid pain, and that an animal or human can learn through receiving either reward or punishment at a specific time called trace conditioning. Trace conditioning is the small and ideal period of time between the subject performing

the desired behavior, and receiving the positive reinforcement as a result of their performance. The reward needs to be given immediately after the completion of the wanted behavior.^[27]

Operant conditioning is different from classical conditioning in that it shapes behavior not solely on bodily reflexes that occur naturally to a specific stimulus, but rather focuses on the shaping of wanted behavior that requires conscious thought, and ultimately requires learning.^[28]

Punishment and reinforcement are the two principal ways in which operant conditioning occurs. Punishment is used to reduce unwanted behavior, and ultimately (from the learner's perspective) leads to avoidance of the punishment, not necessarily avoidance of the unwanted behavior. Punishment is not an appropriate way to increase wanted behavior for animals or humans. Punishment can be divided into two subcategories, positive punishment and negative punishment. Positive punishment is when an aversive aspect of life or thing is added to the subject, for this reason it is called positive punishment. For example, the parent spanking their child would be considered a positive punishment, because a spanking was added to the child. Negative punishment is considered the removal of something loved or desirable from the subject. For example, when a parent puts his child in time out, in reality, the child is losing the opportunity to be with friends, or to enjoy the freedom to do as he pleases. In this example, negative punishment is the removal of the child's desired rights to play with his friends etc.^[29]^[30]

Reinforcement on the other hand is used to increase a wanted behavior either through negative reinforcement or positive reinforcement. Negative reinforcement is defined by removing an undesirable aspect of life, or thing. For example, a dog might learn to sit as the trainer scratches his ears, which ultimately is removing his itches (undesirable aspect). Positive reinforcement is defined by adding a desirable aspect of life or thing. For example, a dog might learn to sit if he receives a treat. In this example the treat was added to the dog's life.^[29]^[30]

Classical conditioning

[edit]

Main article: Classical conditioning

The typical paradigm for *classical conditioning* involves repeatedly pairing an unconditioned stimulus (which unfailingly evokes a reflexive response) with another previously neutral stimulus (which does not normally evoke the response). Following conditioning, the response occurs both to the unconditioned stimulus and to the other, unrelated stimulus (now referred to as the "conditioned stimulus"). The response to the conditioned stimulus is termed a *conditioned response*. The classic example is Ivan Pavlov and his dogs.^[21] Pavlov fed his dogs meat powder, which naturally made the dogs salivate—salivating is a reflexive response to the meat powder. Meat powder is the

unconditioned stimulus (US) and the salivation is the unconditioned response (UR). Pavlov rang a bell before presenting the meat powder. The first time Pavlov rang the bell, the neutral stimulus, the dogs did not salivate, but once he put the meat powder in their mouths they began to salivate. After numerous pairings of bell and food, the dogs learned that the bell signaled that food was about to come, and began to salivate when they heard the bell. Once this occurred, the bell became the conditioned stimulus (CS) and the salivation to the bell became the conditioned response (CR). Classical conditioning has been demonstrated in many species. For example, it is seen in honeybees, in the proboscis extension reflex paradigm.^[31] It was recently also demonstrated in garden pea plants.^[32]

Another influential person in the world of classical conditioning is John B. Watson. Watson's work was very influential and paved the way for B.F. Skinner's radical behaviorism. Watson's behaviorism (and philosophy of science) stood in direct contrast to Freud and other accounts based largely on introspection. Watson's view was that the introspective method was too subjective and that we should limit the study of human development to directly observable behaviors. In 1913, Watson published the article "Psychology as the Behaviorist Views", in which he argued that laboratory studies should serve psychology best as a science. Watson's most famous, and controversial, experiment was "Little Albert", where he demonstrated how psychologists can account for the learning of emotion through classical conditioning principles.

Observational learning

[edit]

Main article: Observational learning

Observational learning is learning that occurs through observing the behavior of others. It is a form of social learning which takes various forms, based on various processes. In humans, this form of learning seems to not need reinforcement to occur, but instead, requires a social model such as a parent, sibling, friend, or teacher with surroundings.

Imprinting

[edit]

Main article: Imprinting (psychology)

Imprinting is a kind of learning occurring at a particular life stage that is rapid and apparently independent of the consequences of behavior. In filial imprinting, young animals, particularly birds, form an association with another individual or in some cases, an object, that they respond to as they would to a parent. In 1935, the Austrian Zoologist Konrad Lorenz discovered that certain birds follow and form a bond if the object makes

sounds.

Play

[edit]

Main article: Play (activity)

Play generally describes behavior with no particular end in itself, but that improves performance in similar future situations. This is seen in a wide variety of vertebrates besides humans, but is mostly limited to mammals and birds. Cats are known to play with a ball of string when young, which gives them experience with catching prey. Besides inanimate objects, animals may play with other members of their own species or other animals, such as orcas playing with seals they have caught. Play involves a significant cost to animals, such as increased vulnerability to predators and the risk of injury and possibly infection. It also consumes energy, so there must be significant benefits associated with play for it to have evolved. Play is generally seen in younger animals, suggesting a link with learning. However, it may also have other benefits not associated directly with learning, for example improving physical fitness.

Play, as it pertains to humans as a form of learning is central to a child's learning and development. Through play, children learn social skills such as sharing and collaboration. Children develop emotional skills such as learning to deal with the emotion of anger, through play activities. As a form of learning, play also facilitates the development of thinking and language skills in children.^[33]

There are five types of play:

1. Sensorimotor play aka functional play, characterized by the repetition of an activity
2. Roleplay occurs starting at the age of three
3. Rule-based play where authoritative prescribed codes of conduct are primary
4. Construction play involves experimentation and building
5. Movement play aka physical play^[33]

These five types of play are often intersecting. All types of play generate thinking and problem-solving skills in children. Children learn to think creatively when they learn through play.^[34] Specific activities involved in each type of play change over time as humans progress through the lifespan. Play as a form of learning, can occur solitarily, or involve interacting with others.

Enculturation

[edit]

Main article: Enculturation

Enculturation is the process by which people learn values and behaviors that are appropriate or necessary in their surrounding culture.^[35] Parents, other adults, and peers shape the individual's understanding of these values.^[35] If successful, enculturation results in competence in the language, values, and rituals of the culture.^[35] This is different from acculturation, where a person adopts the values and societal rules of a culture different from their native one.

Multiple examples of enculturation can be found cross-culturally. Collaborative practices in the Mazahua people have shown that participation in everyday interaction and later learning activities contributed to enculturation rooted in nonverbal social experience.^[36] As the children participated in everyday activities, they learned the cultural significance of these interactions. The collaborative and helpful behaviors exhibited by Mexican and Mexican-heritage children is a cultural practice known as being "acomedido".^[37] Chillihuani girls in Peru described themselves as weaving constantly, following behavior shown by the other adults.^[38]

Episodic learning

[edit]

Episodic learning is a change in behavior that occurs as a result of an event.^[39] For example, a fear of dogs that follows being bitten by a dog is episodic learning. Episodic learning is so named because events are recorded into episodic memory, which is one of the three forms of explicit learning and retrieval, along with perceptual memory and semantic memory.^[40] Episodic memory remembers events and history that are embedded in experience and this is distinguished from semantic memory, which attempts to extract facts out of their experiential context^[41] or – as some describe – a timeless organization of knowledge.^[42] For instance, if a person remembers the Grand Canyon from a recent visit, it is an episodic memory. He would use semantic memory to answer someone who would ask him information such as where the Grand Canyon is. A study revealed that humans are very accurate in the recognition of episodic memory even without deliberate intention to memorize it.^[43] This is said to indicate a very large storage capacity of the brain for things that people pay attention to.^[43]

Multimedia learning

[edit]

Main article: Multimedia learning

Multimedia learning is where a person uses both auditory and visual stimuli to learn information.^[44] This type of learning relies on dual-coding theory.^[45]

E-learning and augmented learning

[edit]

Main article: Electronic learning

Electronic learning or e-learning is computer-enhanced learning. A specific and always more diffused e-learning is mobile learning (m-learning), which uses different mobile telecommunication equipment, such as cellular phones.

When a learner interacts with the e-learning environment, it is called augmented learning. By adapting to the needs of individuals, the context-driven instruction can be dynamically tailored to the learner's natural environment. Augmented digital content may include text, images, video, audio (music and voice). By personalizing instruction, augmented learning has been shown to improve learning performance for a lifetime.^[46] See also minimally invasive education.

Moore (1989)^[47] purported that three core types of interaction are necessary for quality, effective online learning:

- Learner–learner (i.e. communication between and among peers with or without the teacher present),
- Learner–instructor (i.e. student-teacher communication), and
- Learner–content (i.e. intellectually interacting with content that results in changes in learners' understanding, perceptions, and cognitive structures).

In his theory of transactional distance, Moore (1993)^[48] contented that structure and interaction or dialogue bridge the gap in understanding and communication that is created by geographical distances (known as transactional distance).

Rote learning

[edit]

Main article: Rote learning

Rote learning is memorizing information so that it can be recalled by the learner exactly the way it was read or heard. The major technique used for rote learning is *learning by repetition*, based on the idea that a learner can recall the material exactly (but not its meaning) if the information is repeatedly processed. Rote learning is used in diverse areas, from mathematics to music to religion.

Meaningful learning

[edit]

See also: Deeper learning

Meaningful learning is the concept that learned knowledge (e.g., a fact) is fully understood to the extent that it relates to other knowledge. To this end, meaningful learning contrasts with rote learning in which information is acquired without regard to understanding. Meaningful learning, on the other hand, implies there is a comprehensive knowledge of the context of the facts learned.^[49]

Evidence-based learning

[edit]

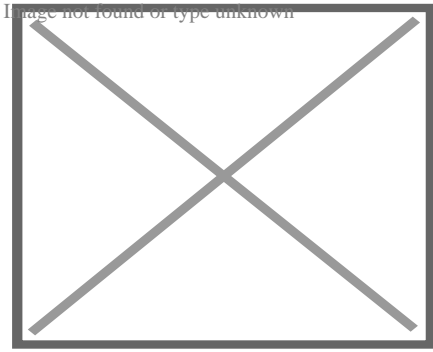
Main article: Evidence-based learning

Evidence-based learning is the use of evidence from well designed scientific studies to accelerate learning. Evidence-based learning methods such as spaced repetition can increase the rate at which a student learns.^[50]

Formal learning

[edit]

Main article: Education



A depiction of the world's oldest continually operating university, the University of Bologna, Italy

Formal learning is a deliberate way attaining of knowledge, which takes place within a teacher-student environment, such as in a school system or work environment.^[51]^[52] The term formal learning has nothing to do with the formality of the learning, but rather the way it is directed and organized. In formal learning, the learning or training departments set out the goals and objectives of the learning and oftentimes learners will be awarded with a diploma, or a type of formal recognition.^[51]^[53]

Non-formal learning

[edit]

Main article: Nonformal learning

Non-formal learning is organized learning outside the formal learning system. For example, learning by coming together with people with similar interests and exchanging viewpoints, in clubs or in (international) youth organizations, and workshops. From the organizer's point of reference, non-formal learning does not always need a main objective or learning outcome. From the learner's point of view, non-formal learning, although not focused on outcomes, often results in an intentional learning opportunity.^[54]

Informal learning

[edit]

Main article: Informal learning

Informal learning is less structured than "non-formal learning". It may occur through the experience of day-to-day situations (for example, one would learn to look ahead while walking because of the possible dangers inherent in not paying attention to where one is going). It is learning from life, during a meal at the table with parents, during play, and

while exploring etc.. For the learner, informal learning is most often an experience of happenstance, and not a deliberately planned experience. Thus this does not require enrollment into any class. Unlike formal learning, informal learning typically does not lead to accreditation.^[54] Informal learning begins to unfold as the learner ponders his or her situation. This type of learning does not require a professor of any kind, and learning outcomes are unforeseen following the learning experience.^[55]

Informal learning is self-directed and because it focuses on day-to-day situations, the value of informal learning can be considered high. As a result, information retrieved from informal learning experiences will likely be applicable to daily life.^[56] Children with informal learning can at times yield stronger support than subjects with formal learning in the topic of mathematics.^[57] Daily life experiences take place in the workforce, family life, and any other situation that may arise during one's lifetime. Informal learning is voluntary from the learner's viewpoint, and may require making mistakes and learning from them. Informal learning allows the individual to discover coping strategies for difficult emotions that may arise while learning. From the learner's perspective, informal learning can become purposeful, because the learner chooses which rate is appropriate to learn and because this type of learning tends to take place within smaller groups or by oneself.^[56]

Nonformal learning and combined approaches

[edit]

The educational system may use a combination of formal, informal, and nonformal learning methods. The UN and EU recognize these different forms of learning (cf. links below). In some schools, students can get points that count in the formal-learning systems if they get work done in informal-learning circuits. They may be given time to assist international youth workshops and training courses, on the condition they prepare, contribute, share, and can prove this offered valuable new insight, helped to acquire new skills, a place to get experience in organizing, teaching, etc.

To learn a skill, such as solving a Rubik's Cube quickly, several factors come into play at once:

- Reading directions helps a player learn the patterns that solve the Rubik's Cube.
- Practicing the moves repeatedly helps build "muscle memory" and speed.
- Thinking critically about moves helps find shortcuts, which speeds future attempts.
- Observing the Rubik's Cube's six colors help anchor solutions in the mind.
- Revisiting the cube occasionally helps retain the skill.

Tangential learning

[edit]

Tangential learning is the process by which people self-educate if a topic is exposed to them in a context that they already enjoy. For example, after playing a music-based video game, some people may be motivated to learn how to play a real instrument, or after watching a TV show that references Faust and Lovecraft, some people may be inspired to read the original work.^[58] Self-education can be improved with systematization. According to experts in natural learning, self-oriented learning training has proven an effective tool for assisting independent learners with the natural phases of learning.^[59]

Extra Credits writer and game designer James Portnow was the first to suggest games as a potential venue for "tangential learning".^[60] Mozelius *et al.*^[61] points out that intrinsic integration of learning content seems to be a crucial design factor, and that games that include modules for further self-studies tend to present good results. The built-in encyclopedias in the *Civilization* games are presented as an example – by using these modules gamers can dig deeper for knowledge about historical events in the gameplay. The importance of rules that regulate learning modules and game experience is discussed by Moreno, C.,^[62] in a case study about the mobile game *Kiwaka*. In this game, developed by Landka in collaboration with ESA and ESO, progress is rewarded with educational content, as opposed to traditional education games where learning activities are rewarded with gameplay.^[63]^[64]

Dialogic learning

[edit]

Main article: Dialogic learning

Dialogic learning is a type of learning based on dialogue.

Incidental learning

[edit]

In *incidental teaching* learning is not planned by the instructor or the student, it occurs as a byproduct of another activity — an experience, observation, self-reflection, interaction,

unique event (e.g. in response to incidents/accidents), or common routine task. This learning happens in addition to or apart from the instructor's plans and the student's expectations. An example of incidental teaching is when the instructor places a train set on top of a cabinet. If the child points or walks towards the cabinet, the instructor prompts the student to say "train". Once the student says "train", he gets access to the train set.

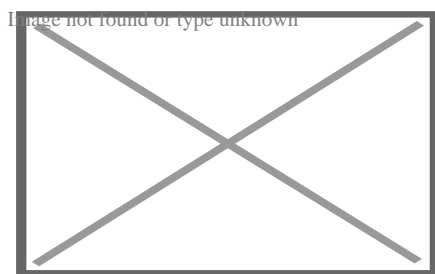
Here are some steps most commonly used in incidental teaching:[⁶⁵]

- An instructor will arrange the learning environment so that necessary materials are within the student's sight, but not within his reach, thus impacting his motivation to seek out those materials.
- An instructor waits for the student to initiate engagement.
- An instructor prompts the student to respond if needed.
- An instructor allows access to an item/activity contingent on a correct response from the student.
- The instructor fades out the prompting process over a period of time and subsequent trials.

Incidental learning is an occurrence that is not generally accounted for using the traditional methods of instructional objectives and outcomes assessment. This type of learning occurs in part as a product of social interaction and active involvement in both online and onsite courses. Research implies that some un-assessed aspects of onsite and online learning challenge the equivalency of education between the two modalities. Both onsite and online learning have distinct advantages with traditional on-campus students experiencing higher degrees of incidental learning in three times as many areas as online students. Additional research is called for to investigate the implications of these findings both conceptually and pedagogically.[⁶⁶]

Domains

[edit]



Future school (1901 or 1910)

Benjamin Bloom has suggested three domains of learning in his taxonomy which are:

- Cognitive: To recall, calculate, discuss, analyze, problem solve, etc.
- Psychomotor: To dance, swim, ski, dive, drive a car, ride a bike, etc.

- Affective: To like something or someone, love, appreciate, fear, hate, worship, etc.

These domains are not mutually exclusive. For example, in learning to play chess, the person must learn the rules (cognitive domain)—but must also learn how to set up the chess pieces and how to properly hold and move a chess piece (psychomotor). Furthermore, later in the game the person may even learn to love the game itself, value its applications in life, and appreciate its history (affective domain).^[67]

Transfer

[edit]

Transfer of learning is the application of skill, knowledge or understanding to resolve a novel problem or situation that happens when certain conditions are fulfilled. Research indicates that learning transfer is infrequent; most common when "... cued, primed, and guided..."^[68] and has sought to clarify what it is, and how it might be promoted through instruction.

Over the history of its discourse, various hypotheses and definitions have been advanced. First, it is speculated that different types of transfer exist, including: near transfer, the application of skill to solve a novel problem in a similar context; and far transfer, the application of skill to solve a novel problem presented in a different context.^[69] Furthermore, Perkins and Salomon (1992) suggest that positive transfer in cases when learning supports novel problem solving, and negative transfer occurs when prior learning inhibits performance on highly correlated tasks, such as second or third-language learning.^[70] Concepts of positive and negative transfer have a long history; researchers in the early 20th century described the possibility that "...habits or mental acts developed by a particular kind of training may inhibit rather than facilitate other mental activities".^[71] Finally, Schwarz, Bransford and Sears (2005) have proposed that transferring knowledge into a situation may differ from transferring knowledge out to a situation as a means to reconcile findings that transfer may both be frequent and challenging to promote.^[72]

A significant and long research history has also attempted to explicate the conditions under which transfer of learning might occur. Early research by Ruger, for example, found that the "level of attention", "attitudes", "method of attack" (or method for tackling a problem), a "search for new points of view", a "careful testing of hypothesis" and "generalization" were all valuable approaches for promoting transfer.^[73] To encourage transfer through teaching, Perkins and Salomon recommend aligning ("hugging") instruction with practice and assessment, and "bridging", or encouraging learners to reflect on past experiences or make connections between prior knowledge and current content.^[70]

Factors affecting learning

[edit]

Main article: Evidence-based learning

Genetics

[edit]

Main article: Heritability of IQ

Some aspects of intelligence are inherited genetically, so different learners to some degree have different abilities with regard to learning and speed of learning.^[*citation needed*]

Socioeconomic and physical conditions

[edit]

Problems like malnutrition, fatigue, and poor physical health can slow learning, as can bad ventilation or poor lighting at home, and unhygienic living conditions.^{[74][75]}

The design, quality, and setting of a learning space, such as a school or classroom, can each be critical to the success of a learning environment. Size, configuration, comfort—fresh air, temperature, light, acoustics, furniture—can all affect a student's learning. The tools used by both instructors and students directly affect how information is conveyed, from the display and writing surfaces (blackboards, markerboards, tack surfaces) to digital technologies. For example, if a room is too crowded, stress levels rise, student attention is reduced, and furniture arrangement is restricted. If furniture is incorrectly arranged, sightlines to the instructor or instructional material are limited and the ability to suit the learning or lesson style is restricted. Aesthetics can also play a role, for if student morale suffers, so does motivation to attend school.^{[76][77]}

Psychological factors and teaching style

[edit]

Intrinsic motivation, such as a student's own intellectual curiosity or desire to experiment or explore, has been found to sustain learning more effectively than extrinsic motivations such as grades or parental requirements. Rote learning involves repetition in order to reinforce facts in memory, but has been criticized as ineffective and "drill and kill" since it kills intrinsic motivation. Alternatives to rote learning include active learning and meaningful learning.

The speed, accuracy, and retention, depend upon aptitude, attitude, interest, attention, energy level, and motivation of the students. Students who answer a question properly or give good results should be praised. This encouragement increases their ability and helps them produce better results. Certain attitudes, such as always finding fault in a student's answer or provoking or embarrassing the student in front of a class are counterproductive. ^[78]^[79]^[need quotation to verify]

Certain techniques can increase long-term retention:^[80]

- The spacing effect means that lessons or studying spaced out over time (spaced repetition) are better than cramming
- Teaching material to other people
- "Self-explaining" (paraphrasing material to oneself) rather than passive reading
- Low-stakes quizzing

Epigenetic factors

[edit]

Further information: Epigenetics in learning and memory

The underlying molecular basis of learning appears to be dynamic changes in gene expression occurring in brain neurons that are introduced by epigenetic mechanisms. Epigenetic regulation of gene expression involves, most notably, chemical modification of DNA or DNA-associated histone proteins. These chemical modifications can cause long-lasting changes in gene expression. Epigenetic mechanisms involved in learning include the methylation and demethylation of neuronal DNA as well as methylation, acetylation and deacetylation of neuronal histone proteins.

During learning, information processing in the brain involves induction of oxidative modification in neuronal DNA followed by the employment of DNA repair processes that introduce epigenetic alterations. In particular, the DNA repair processes of non-homologous end joining and base excision repair are employed in learning and memory formation.^[81]^[82]

General cognition-related factors

[edit]

This section is an excerpt from Development of the nervous system in humans § Adult neural development.[edit]

The nervous system continues to develop during adulthood until brain death. For example:

- physical exercise has neurobiological effects
- the consumption of foods (or nutrients), obesity,^[83] alterations of the microbiome, drinks, dietary supplements, recreational drugs and medications^{[84][85]} may possibly also have effects on the development of the nervous system
- various diseases, such as COVID-19, have effects on the development of the nervous system
 - For example, several genes have been identified as being associated with changes in brain structure over lifetime and are potential Alzheimer's disease therapy-targets.^{[86][87]}
- psychological events such as mental trauma and resilience-building
- exposure to environmental pollution and toxins such as air pollution may have effects on the further development of the nervous system
- other activities may also have effects on the development of the nervous system, such as lifelong learning, retraining, and types of media- and economic activities
- broadly, brain aging

Adult learning vs children's learning

[edit]

See also: Aging brain

[icon] **This section needs expansion.** You can help by adding to it. *(January 2023)*

Learning is often more efficient in children and takes longer or is more difficult with age. A study using neuroimaging identified rapid neurotransmitter GABA boosting as a major potential explanation-component for why that is.^{[88][89]}

Children's brains contain more "silent synapses" that are inactive until recruited as part of neuroplasticity and flexible learning or memories.^{[90][91]} Neuroplasticity is heightened during critical or sensitive periods of brain development, mainly referring to brain development during child development.^[92]

However researchers, after subjecting late middle aged participants to university courses, suggest perceived age differences in learning may be a result of differences in time, support, environment, and attitudes, rather than inherent ability.^[93]

What humans learn at the early stages, and what they learn to apply, sets humans on course for life or has a disproportional impact.^[94] Adults usually have a higher capacity to select what they learn, to what extent and how. For example, children may learn the given subjects and topics of school curricula via classroom blackboard-transcription

handwriting, instead of being able to choose specific topics/skills or jobs to learn and the styles of learning. For instance, children may not have developed consolidated interests, ethics, interest in purpose and meaningful activities, knowledge about real-world requirements and demands, and priorities.

In animal evolution

[edit]

Animals gain knowledge in two ways. First is learning—in which an animal gathers information about its environment and uses this information. For example, if an animal eats something that hurts its stomach, it learns not to eat that again. The second is innate knowledge that is genetically inherited. An example of this is when a horse is born and can immediately walk. The horse has not learned this behavior; it simply knows how to do it.^[95] In some scenarios, innate knowledge is more beneficial than learned knowledge. However, in other scenarios the opposite is true—animals must learn certain behaviors when it is disadvantageous to have a specific innate behavior. In these situations, learning evolves in the species.

Costs and benefits of learned and innate knowledge

[edit]

In a changing environment, an animal must constantly gain new information to survive. However, in a stable environment, this same individual needs to gather the information it needs once, and then rely on it for the rest of its life. Therefore, different scenarios better suit either learning or innate knowledge. Essentially, the cost of obtaining certain knowledge versus the benefit of already having it determines whether an animal evolved to learn in a given situation, or whether it innately knew the information. If the cost of gaining the knowledge outweighs the benefit of having it, then the animal does not evolve to learn in this scenario—but instead, non-learning evolves. However, if the benefit of having certain information outweighs the cost of obtaining it, then the animal is far more likely to evolve to have to learn this information.^[95]

Non-learning is more likely to evolve in two scenarios. If an environment is static and change does not or rarely occurs, then learning is simply unnecessary. Because there is no need for learning in this scenario—and because learning could prove disadvantageous due to the time it took to learn the information—non-learning evolves. Similarly, if an environment is in a constant state of change, learning is also disadvantageous, as anything learned is immediately irrelevant because of the changing environment.^[95] The

learned information no longer applies. Essentially, the animal would be just as successful if it took a guess as if it learned. In this situation, non-learning evolves. In fact, a study of *Drosophila melanogaster* showed that learning can actually lead to a decrease in productivity, possibly because egg-laying behaviors and decisions were impaired by interference from the memories gained from the newly learned materials or because of the cost of energy in learning.[⁹⁶]

However, in environments where change occurs within an animal's lifetime but is not constant, learning is more likely to evolve. Learning is beneficial in these scenarios because an animal can adapt to the new situation, but can still apply the knowledge that it learns for a somewhat extended period of time. Therefore, learning increases the chances of success as opposed to guessing.[⁹⁵] An example of this is seen in aquatic environments with landscapes subject to change. In these environments, learning is favored because the fish are predisposed to learn the specific spatial cues where they live.[⁹⁷]

In plants

[edit]

In recent years, plant physiologists have examined the physiology of plant behavior and cognition. The concepts of learning and memory are relevant in identifying how plants respond to external cues, a behavior necessary for survival. Monica Gagliano, an Australian professor of evolutionary ecology, makes an argument for associative learning in the garden pea, *Pisum sativum*. The garden pea is not specific to a region, but rather grows in cooler, higher altitude climates. Gagliano and colleagues' 2016 paper aims to differentiate between innate phototropism behavior and learned behaviors.[³²] Plants use light cues in various ways, such as to sustain their metabolic needs and to maintain their internal circadian rhythms. Circadian rhythms in plants are modulated by endogenous bioactive substances that encourage leaf-opening and leaf-closing and are the basis of nyctinastic behaviors.[⁹⁸]

Gagliano and colleagues constructed a classical conditioning test in which pea seedlings were divided into two experimental categories and placed in Y-shaped tubes.[³²] In a series of training sessions, the plants were exposed to light coming down different arms of the tube. In each case, there was a fan blowing lightly down the tube in either the same or opposite arm as the light. The unconditioned stimulus (US) was the predicted occurrence of light and the conditioned stimulus (CS) was the wind blowing by the fan. Previous experimentation shows that plants respond to light by bending and growing towards it through differential cell growth and division on one side of the plant stem mediated by auxin signaling pathways.[⁹⁹]

During the testing phase of Gagliano's experiment, the pea seedlings were placed in different Y-pipes and exposed to the fan alone. Their direction of growth was

subsequently recorded. The 'correct' response by the seedlings was deemed to be growing into the arm where the light was "predicted" from the previous day. The majority of plants in both experimental conditions grew in a direction consistent with the predicted location of light based on the position of the fan the previous day.^[32] For example, if the seedling was trained with the fan and light coming down the same arm of the Y-pipe, the following day the seedling grew towards the fan in the absence of light cues despite the fan being placed in the opposite side of the Y-arm. Plants in the control group showed no preference to a particular arm of the Y-pipe. The percentage difference in population behavior observed between the control and experimental groups is meant to distinguish innate phototropism behavior from active associative learning.^[32]

While the physiological mechanism of associative learning in plants is not known, Telewski et al. describes a hypothesis that describes photoreception as the basis of mechano-perception in plants.^[100] One mechanism for mechano-perception in plants relies on MS ion channels and calcium channels. Mechanosensory proteins in cell lipid bilayers, known as MS ion channels, are activated once they are physically deformed in response to pressure or tension. Ca²⁺ permeable ion channels are "stretch-gated" and allow for the influx of osmolytes and calcium, a well-known second messenger, into the cell. This ion influx triggers a passive flow of water into the cell down its osmotic gradient, effectively increasing turgor pressure and causing the cell to depolarize.^[100] Gagliano hypothesizes that the basis of associative learning in *Pisum sativum* is the coupling of mechanosensory and photosensory pathways and is mediated by auxin signaling pathways. The result is directional growth to maximize a plant's capture of sunlight.^[32]

Gagliano et al. published another paper on habituation behaviors in the *mimosa pudica* plant whereby the innate behavior of the plant was diminished by repeated exposure to a stimulus.^[18] There has been controversy around this paper and more generally around the topic of plant cognition. Charles Abrahamson, a psychologist and behavioral biologist, says that part of the issue of why scientists disagree about whether plants have the ability to learn is that researchers do not use a consistent definition of "learning" and "cognition".^[101] Similarly, Michael Pollan, an author, and journalist, says in his piece *The Intelligent Plant* that researchers do not doubt Gagliano's data but rather her language, specifically her use of the term "learning" and "cognition" with respect to plants.^[102] A direction for future research is testing whether circadian rhythms in plants modulate learning and behavior and surveying researchers' definitions of "cognition" and "learning".

Machine learning

[edit]

 This section **needs expansion**. You can help by adding to it. (February 2020)

Robots can learn to cooperate.

Main article: Machine learning

Machine learning, a branch of artificial intelligence, concerns the construction and study of systems that can learn from data. For example, a machine learning system could be trained on email messages to learn to distinguish between spam and non-spam messages. Most of the Machine Learning models are based on probabilistic theories where each input (e.g. an image) is associated with a probability to become the desired output.

Types

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Phases

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See also

[edit]

- 21st century skills – Skills identified as being required for success in the 21st century
- Anticipatory socialization – Process in which people take on the values of groups that they aspire to join
- Epistemology – Philosophical study of knowledge
- Implicit learning – in learning psychology
- Instructional theory – Theory that offers explicit guidance on how to better help people learn and develop
- Learning sciences – Critical theory of learning
- Lifelong learning – Ongoing, voluntary, and self-motivated pursuit of knowledge
- Living educational theory
- Media psychology – Area of psychology
- Subgoal labeling – Cognitive process

Information theory

[edit]

- Algorithmic information theory – Subfield of information theory and computer science
- Algorithmic probability – mathematical method of assigning a prior probability to a given observation
- Bayesian inference – Method of statistical inference
- Inductive logic programming – learning logic programs from data

- Inductive probability – Determining the probability of future events based on past events
- Information theory – Scientific study of digital information
- Minimum description length – Model selection principle
- Minimum message length – Formal information theory restatement of Occam's Razor
- Occam's razor – Philosophical problem-solving principle
- Solomonoff's theory of inductive inference – A mathematical theory
- AIXI – Mathematical formalism for artificial general intelligence

Types of education

[edit]

- Autodidacticism – Independent education without the guidance of teachers
- Andragogy – Methods and principles in adult education
- Pedagogy – Theory and practice of education

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Notes

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- Paivio, A. (1971). *Imagery and verbal processes*. New York: Holt, Rinehart, and Winston. ISBN 978-0-03-085173-5.

Further reading

[edit]

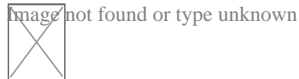
Library resources about

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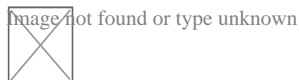
- Resources in your library
- Ulrich Boser (2019). *Learn Better: Mastering the Skills for Success in Life, Business, and School, or How to Become an Expert in Just About Anything*. Rodale Books. ISBN 978-0593135310.

External links

[edit]



Wikimedia Commons has media related to **Learning**.



Wikiquote has quotations related to **Learning**.

- *How People Learn: Brain, Mind, Experience, and School* (expanded edition) published by the National Academies Press
- *Applying Science of Learning in Education: Infusing Psychological Science into the Curriculum* published by the American Psychological Association

Links to related articles

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Ethology

Branches

- o Animal cognition
- o Animal communication
- o Animal consciousness
- o Animal culture
- o Animal sexual behaviour
- o Animal welfare science
- o Anthrozoology
- o Bee learning and communication
- o Behavioural ecology
- o Behavioral endocrinology
- o Behavioural genetics
- o Breed
- o Cognitive ethology
- o Comfort behaviour
 - o Grooming
- o Comparative psychology
- o Emotion in animals
- o Ethogram
- o Evolutionary neuroscience
- o Feeding
- o Hover
- o Human ethology
- o Instinct
- o Learning
- o Neuroethology
- o Pain in animals
- o Philosophical ethology
- o Sociobiology
- o Stereotypy
- o Structures
 - o Hive
 - o Honeycomb
 - o Nest
 - o Instinct
- o Swarm
- o Tool use by non-humans
- o Zoosemiotics
- o Zoomusicology

Ethologists

- Patrick Bateson
- Marc Bekoff
- Donald Broom
- John B. Calhoun
- Charles Darwin
- Marian Dawkins
- Richard Dawkins
- Irenäus Eibl-Eibesfeldt
- Dian Fossey
- Karl von Frisch
- Jane Goodall
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- Konrad Lorenz
- Desmond Morris
- Thomas Sebeok
- William Homan Thorpe
- Nikolaas Tinbergen
- Jakob von Uexküll
- Wolfgang Wickler
- E. O. Wilson
- Solly Zuckerman
- Association for the Study of Animal Behaviour
- International Society for Applied Ethology
- *Animal Behaviour*
- *Animal Cognition*
- *Animal Welfare*
- *Behavioral Ecology*
- *Behaviour*

Societies

Journals

-  Category Image not found or type unknown

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Human intelligence topics

Types

- Collective
- Emotional
- Intellectual
- Linguistic
- Multiple
- Social
- Spatial (visuospatial)

**Abilities,
traits,
and
constructs**

- Cognition
- Cognitive liberty
- Communication
- Creativity
- Fluid and crystallized intelligence
- *g* factor
- Intellect
- Intelligence quotient
- Knowledge
- Learning
- Memory
- Problem solving
- Reasoning
- Skill
- Thought (abstraction)
- Understanding
- Visual processing

**Models
and
theories**

- Cattell–Horn–Carroll theory
- Fluid and crystallized intelligence
- Multiple-intelligences theory
- PASS theory
- Three-stratum theory
- Triarchic theory
- Evolution of human intelligence

**Areas of
research**

- Heritability of IQ
- Psychometrics
- Intelligence and environment / fertility / height / health / longevity / neuroscience / personality / race / sex

-  Outline of human intelligence / thought

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Learning

Non-associative learning

- Habituation
- Sensitization
- Classical conditioning

Associative learning

- Imprinting
- Observational learning
- Operant conditioning

Insight learning

- Abductive reasoning
- Deductive reasoning
- Inductive reasoning

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Mental processes

Cognition

- Association
- Awareness
- Cognitive flexibility
- Cognitive liberty
- Forecasting
 - affective
- Foresight
- Comprehension
- Consciousness
- Critical thinking
- Decision-making
- Imagination
- Intuition
- Problem solving
 - methods
 - strategies
- Prospection
- Amodal
- Color
 - RGB model
- Depth
- Form
- Haptic (Touch)
- Perception as interpretation
- Peripheral
- Social
- Sound
 - Harmonics
 - Pitch
 - Speech
- Visual
- Consolidation
- Encoding
- Storage
- Recall

Perception

Memory

Other

- Attention
- Experiential avoidance
- Higher nervous activity
- Intention
- Ironic process theory
- Learning
- Mental fatigue
- Relational frame theory
- Mental set
- Thinking
- Thought suppression
- Volition

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Frequently Asked Questions

What are the key risks associated with whistleblower actions in medical coding practices?

The key risks include legal and financial penalties due to fraudulent billing, damage to the practices reputation, potential loss of accreditation or licenses, and operational disruptions caused by investigations.

How can medical practices ensure compliance with coding regulations to minimize whistleblower risks?

Practices can ensure compliance by regularly training staff on up-to-date coding standards, conducting internal audits, implementing robust compliance programs, and maintaining clear documentation of all billing activities.

What steps should a medical practice take if a whistleblower complaint is filed related to its coding practices?

Upon receiving a complaint, the practice should promptly conduct an internal investigation, cooperate with any external investigations, review and rectify any identified issues in their coding processes, and consult legal counsel for guidance.

How can fostering an ethical workplace culture reduce the likelihood of whistleblower incidents in medical coding?

Encouraging open communication about concerns without fear of retaliation, promoting transparency in operations, emphasizing adherence to ethical guidelines during training sessions, and providing employees with anonymous reporting channels can help build trust and prevent potential misconduct.

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