

# HUMANISTIC IDEOLOGY AND EDUCATIONAL VALUES IN THE LY AND TRAN DYNASTIES

Ideologia humanística e valores educacionais nas Dinastias Ly e Tran

Vu Thi Phuong Le Vinh University, Vietnam levtp@vinhuni.edu.vn

**Dinh Quang Thanh** 

Ho Chi Minh National Academy of Politics, Hanoi, Vietnam <a href="mailto:dinhquangthanhvn@gmail.com">dinhquangthanhvn@gmail.com</a>

#### **ABSTRACT**

The ideology of the Ly and Tran dynasties (11th–13th centuries) was shaped by the unique historical and social conditions of Dai Viet. During this period, the need to establish a strong, independent, and unified state was paramount, especially in the face of external threats from the Nguyen and Mong forces. To foster national solidarity and resilience, the Ly and Tran rulers integrated humanistic principles from Confucianism, Buddhism, and Daoism, forming a distinctive ideology. A key aspect of this ideology was its emphasis on education as a means of cultivating moral character and ethical behavior. The dynasties prioritized the development of an educated elite while also promoting broader educational initiatives that instilled values of altruism, tolerance, and compassion. This commitment to education aimed to elevate both individual and societal well-being, reinforcing the ideals of sublime humanity, dignity, and social harmony. By synthesizing the teachings of Confucianism, Buddhism, and Daoism, the Ly and Tran dynasties established a humanistic tradition that profoundly influenced the cultural and intellectual deve.

**Keywords:** Ly - Tran dynasties, humanistic ideology, Educational Values, Dai Viet, Vietnam.



#### **RESUMO**

A ideologia das dinastias Ly e Tran (séculos XI a XIII) foi moldada pelas condições históricas e sociais únicas do Dai Viet. Durante esse período, a necessidade de estabelecer um estado forte, independente e unificado era primordial, especialmente diante das ameaças externas das forças Nguyen e Mong. Para promover a solidariedade e a resiliência nacionais, os governantes Ly e Tran integraram princípios humanísticos do confucionismo, budismo e taoísmo, formando uma ideologia distinta. Um aspecto fundamental dessa ideologia era sua ênfase na educação como meio de cultivar o caráter moral e o comportamento ético. As dinastias priorizavam o desenvolvimento de uma elite educada, ao mesmo tempo em que promoviam iniciativas educacionais mais amplas que incutiam valores de altruísmo, tolerância e compaixão. Esse compromisso com a educação visava elevar o bem-estar individual e social, reforçando os ideais de humanidade sublime, dignidade e harmonia social. Ao sintetizar os ensinamentos do confucionismo, budismo e taoísmo, as dinastias Ly e Tran estabeleceram uma tradição humanística que influenciou profundamente o desenvolvimento cultural e intelectual.

**Palavras-chave:** Ly - Dinastias Tran, ideologia humanística, Valores Educacionais, Dai Viet, Vietname.

#### Introduction

Humanity stands as a central pillar of the ideology of the Ly and Tran dynasties, shaped profoundly by the historical and social dynamics of Dai Viet between the 11th and 13th centuries. This ideology emerged from the rich tapestry of Vietnamese humanistic values, drawing upon the wisdom of Confucianism, Buddhism, and Taoism, which were seamlessly integrated and evolved over time. Within this framework, the concept of humanity became particularly prominent, emphasizing the elevation of human dignity, love, and a deep concern for the welfare of all individuals. The ideology advocated for principles such as altruism, tolerance, and mercy, underscoring the importance of compassion in societal interactions. Furthermore, it prioritized the education and nurturing of individuals toward the cultivation of virtuous values, reflecting a commitment to moral development that would benefit the entire community. To explore this significant theme in greater depth, I will examine the perspectives of the great thinkers of the Ly and Tran dynasties, highlighting their contributions to the understanding of humanity within this ideological context. Their insights reveal not only the philosophical underpinnings of the time but also the enduring legacy of humanistic thought that continues to resonate within Vietnamese culture today.



#### Literature Review

Research on humanism within the educational ideology of the Ly and Tran dynasties reveals a rich tapestry of thought shaped by the historical and social contexts of 11th to 13th century Vietnam. This exploration can be categorized into several key themes that provide insight into the formation and impact of these ideologies.

Foundational Conditions and Premises. Studies that delve into the foundational conditions for the emergence of ideas during the Ly-Tran period often highlight the historical backdrop of Vietnam's feudal society. Works such as the "Complete Annals of Dai Viet" (1998) serve as essential references, offering a chronological account of events and insights into the societal structure of the time. Phan Huy Chu's "Rule of the Dynasties" (2006) further illuminates the governance and educational systems that underpinned this era. Additionally, "The War Against Nguyen-Mong Invaders in the 13th Century" provides context regarding national unity against external threats, emphasizing the role of education in fostering a collective identity. These foundational texts underscore how historical challenges influenced the intellectual landscape, promoting humanistic values as a means of nation-building.

Content and Characteristics of the Ideology. The ideological content and its unique characteristics during the Ly and Tran dynasties emerge through a synthesis of Confucian, Buddhist, and Taoist thought. Scholars, such as those from the Institute of Literature, explore the integration of these philosophies into educational practices and moral teachings. "Vietnamese Thought in the Ly-Tran Period" offers a comprehensive analysis of how these ideologies were operationalized in governance and education, reflecting a commitment to enhancing human values and ethical behavior. This melding of philosophies not only shaped the educational curriculum but also instilled a sense of social responsibility, altruism, and a deep respect for human dignity.

Historical Significance and Value. Critical assessments of the historical significance of the Ly-Tran ideology reveal its lasting impact on Vietnamese

education and society. "The History of Vietnamese Education Before the August Revolution - 1945" examines the evolution of educational practices rooted in humanistic ideals, highlighting how these values influenced later developments in Vietnam. Tran Van Giau's work on the development of Vietnamese thought illustrates the continuity of these humanistic principles into modern times. Additionally, the "Social Research in Vietnam in the Ly-Tran Period" emphasizes the ideological legacy of this era, suggesting that the commitment to humanism established a framework for subsequent social and political reforms.

In summary, the research on humanism in the educational ideology of the Ly and Tran dynasties not only contextualizes the historical and social conditions of the time but also showcases the profound influence of these ideologies on Vietnam's educational landscape. By examining the foundational premises, content characteristics, and historical significance, we gain a deeper appreciation for how humanistic values shaped the nati

# Methodology

Purpose: This research aims to explore the humanistic ideology and educational values of the Ly and Tran dynasties, focusing on the integration of Confucianism, Buddhism, and Daoism in shaping moral and intellectual development. It examines key aspects such as the emphasis on human dignity, love, and social responsibility, as well as the commitment to fostering virtues like altruism, tolerance, and compassion through education. Additionally, the study investigates how education was perceived as a means of nurturing ethical individuals, thereby contributing to a society rooted in moral integrity and collective well-being.

Methodology: This study adopts a Marxist philosophical framework to critically analyze the historical evolution of educational thought in the Ly and Tran dynasties. A combination of research methods is employed, including analytical and synthetic approaches to distill core concepts, and historical and logical methods to contextualize the ideology within Vietnamese history. Inductive and deductive

reasoning are utilized to draw insights from specific educational practices and form broader conclusions. Furthermore, abstraction and generalization highlight essential themes, while comparative and collative methods juxtapose different ideological influences. The study also integrates direct quotations from historical texts, grounding the analysis in primary sources and ensuring a comprehensive examination.

Main Findings: The research reveals that humanistic values were central to the educational ideology of the Ly and Tran dynasties. Education was not merely a means of knowledge transmission but a tool for shaping ethical individuals and a harmonious society. The dynasties promoted a holistic educational philosophy that emphasized moral cultivation, social responsibility, and the development of virtues such as altruism, tolerance, and mercy. These values were deeply embedded in both governance and educational institutions, reinforcing a vision of education as a transformative force for both individuals and the nation.

The study further underscores how the humanistic and educational ideals of the Ly and Tran dynasties have left a lasting impact on Vietnamese intellectual and moral traditions. By prioritizing ethical education and social compassion, these dynasties established a foundation for a cultural legacy that continues to influence contemporary educational thought in Vietnam, shaping generations with a strong sense of empathy and civic duty.

### **Results and Discussion**

The Theoretical Basis for the Formation of Humanity Ideology during the Ly – Tran Dynasties

The history of Vietnamese society in the 11th to 13th centuries was marked by significant challenges and aspirations, particularly the imperative to construct a robust and unified nation Dai Viet. This era called for a concerted national effort to foster solidarity against the fierce invasions of the Nguyen-Mong forces. Alongside this, the rich traditions of Confucianism, Buddhism, and Taoism contributed to a unique synthesis of humanitarian values that would shape the ideological landscape

of the time. The ideology during the Ly-Tran period, deeply rooted in the humanistic spirit of the Vietnamese people, emerged as a prominent force. It was characterized by a profound commitment to humanity, which gained widespread recognition and importance. At its core, this ideology reflected the intrinsic humanity that is a hallmark of Vietnamese culture.

Firstly, humanity embodies the cherished qualities of the Vietnamese people, emphasizing solidarity, community cohesion, tolerance, and compassion. These values, shaped by the historical context of the nation, became the moral foundation for individuals within society. The ideological depth of this period stands as a testament to the rich humanistic traditions of Vietnam, highlighting the enduring legacy of these values that continue to resonate in the collective consciousness of the Vietnamese people. Through this lens, the Ly-Tran ideology serves not only as a reflection of the time but also as a guiding principle that underscores the importance of nurturing a compassionate and united society, rooted in the profound humanistic values that have long defined Vietnamese identity;

Secondly, the Ly – Tran period's ideology was formed in the context that the nation of Dai Viet had just escaped from the brutal domination of the feudal forces in the North, the desire of an independent nation, a prosperous country and a safe society was much stronger than ever. Therefore, the concern towards building an independent nation, training people's perfection, building a peaceful, prosperous society attached with humanity was always reflected deeply from the views and actions of all levels of Kings and thinkers during this period;

Thirdly, the humanistic spirit was the key to solve historical, political and social problems at that time. Also for the purpose of raising the humanistic spirit in awareness and actions, the feudal aristocracy in the Ly - Tran period was willing to sacrifice their own social class' benefits for the nation's happiness. While the country was on the verge of being invaded by the violent Nguyen-Mong enemy, it was the benevolence and human spirit that the court advocated to *tolerate citizens*, to be *friends with citizens*, to *build a father-son army*... for those that will be loved by citizens, to build trust among citizens, create synergy, defeat the enemy and remain a long-lasting reign; Fourthly, the ideology under the Ly - Tran period is the



crystallization, inheritance and development of ideas with the humanistic spirit of the Three religions (Confucianism - Buddhism - Taoism) on the basis of the quintessence and human values in Vietnamese culture's tradition. In addition, the humanism of Buddhism with a compassionate and merciful hear directs people to good values; expressed through the exaltation in *mind*, *Buddha nature instinct* in each individual and the interest in educating people through gender, concentration, insight and synthesis of methods of answering, praying, chanting, amending, ... The peak was the enthusiastic and determined spirit joining in the war against enemy of the nation, the desire for happiness from the representatives of Tran dynasty such as Tran Thai Tong, Tue Trung Thuong, and Tran Nhan Tong,...

# The basic concepts of humanity ideology during the Ly - Tran Dynasties

Humanity in the ideology of Ly - Tran dynasties spreads love and great concern towards people

Kings and mandarins of the Ly - Tran period expressed their love towards people, rather in a more respectful way to laborers than being general and abstract, and an empathy for the poor and the lower class, ... It is the simple, sincere, generous and kind love from the kings and mandarins that erased the social-class boundaries and bureaucracy on a basis of the spirit "love citizens", "be close to citizens" and "respect citizens". They were loved and trusted which created a great strength for national unity during the war against enemy's invasion.

A good example for showing love for and taking care of citizens is King Ly Thai To. For his time with the throne, he always paid special attention to people: "In December of winter, the inaugural ceremony Thuy Hoa palace was taken place and people were given an amnesty for 3 years. The orphans, widows, elderly who were under long-term tax deficits were forgive" (Vietnam Academy of Social Sciences, 1998, p. 242). During Tran dynasty, King Tran Thai Tong represents greatest love and concern for people. In his adolescence, he always proved to be a wise King wholeheartedly loved his people. He always highly appreciated the spirit of "love citizens", "be close to citizens" full of compassion with the principle of Buddhism: "As a soldier, a man must take the will of the whole as his will; take the heart of the

whole as his own" (Institute of Literature, 1989, p. 29). The same for King Tran Nhan Tong, he was always interested in the basic interests of people, loved people, kept people's mind in peace. In 1290 (The year of Tiger), people suffered from the extreme famine. Having seen people selling land and even their sons and daughters as slaves, King Tran Nhan Tong "gave the command to support the poor with rice and apply tax-free for adults" (Vietnam Academy of Social Sciences, 1998, p. 67). Until 1292, the King "gave the command that for those innocent people who bought for being slaves would have been released with a ransom; land fields and properties are excluded because of the high death toll during the famine in the year of Tiger and the year of Cat") (Vietnam Academy of Social Sciences, 1998, p. 68).

Besides, Tran Nhan Tong also *could deeply understand and sympathized with* his people's living condition, no matter who they were, the rich or the poor, even for the imperial maids. As what was written in "Khuê Oán"

Wake up in the morning, lifted curtains, falling roses
Birds stop singing, sulk winter wind.
Wondering on West mansion, the sun is setting
Towards the East – the shade, flowers and branches (Institute of Literature, 1989, p. 462)

For the wish that everyone can live in peace and harmony, for the worry deep in his heart and the responsibility for country, a patriotism and generosity, in "Hich Tướng Sĩ" (Translation: Tran Hung Dao's proclamation to his officers), Tran Quoc Tuan (also called Tran Hung Dao) with strong words in his proclamation expressing a brave heart and a deep hatred for the enemy: "Very often I do not mind eating, midnight get pillows to tear, heart hurt like a cut, tears are pouring down, how angry I am to not having yet split their body into two, skinned them alive, eaten their liver and drunk their blood; Even though a hundred of our bodies are exposed on the grass, thousands of bodies wrapped in horse skin, that is still our strong will" (Institute of Literature, 1989, p. 391).





# The humanity of the Ly-Tran period's ideology manifests itself in altruism, tolerance and mercy

The spirit of altruism and exceptional tolerance is vividly illustrated in the actions of King Ly Thai To, who famously commanded that "the fugitives be allowed to return to their hometowns" (Vietnam Academy of Social Sciences, 1998, p. 242). His compassion extended beyond his own subjects; he also ordered provisions of clothing, food, and medicine for the 28 soldiers captured from the Chiêm Thành army, ensuring their safe return to their homeland. This decree included forgiveness for those in the Southern region, specifically in Thach Ha district of Chau Hoan, allowing them to go back to their villages without fear of reprisal (Vietnam Academy of Social Sciences, 1998, p. 242).

Furthermore, King Ly Thai Tong exemplified this ethos of empathy not only towards his own people but also towards the defeated Chiêm Thành forces. Recognizing the human cost of war, he issued a decree asserting, "Anyone who wrongfully kills a Chiêm Thành person shall face severe punishment" (Vietnam Academy of Social Sciences, 1998, p. 266). This profound commitment to compassion and justice underscores the deep humanistic values that characterized the leadership of the Ly dynasty, fostering a culture of tolerance and understanding in a tumultuous period. Such actions not only reflect the king's character but also set a precedent for governance that prioritizes humanity over conflict.

In *Complete Annals of Dai Viet*, the commands from King Ly Thanh Tong, in the freezing weather condition, to the dignitaries are well recorded, which shows his empathy and mercy for those who even were the inmates: "I, in the palace, still feel cold when being kept warmed by animal bones and wearing mink fur coat. Thinking of the prisoners in prison have to suffer from shackles, without knowing if it is right or wrong, the stomach does not feel full, the body is not fully covered, have to struggle with the cold wind, or some died without once committing a sin, I can feel the pain. So I ordered Huu Ti to distribute blankets, and provide meals twice a day" (Vietnam Academy of Social Sciences, 1998, p. 271). Or once, the king took a lawsuit at Thien Khanh Palace, pointing to the princess Dong Thien standing next to him and telling the prison: "I love my children in the way I love my people, as a father



of all". I feel so sorry for those who accidently commit criminal law that resulted from not having enough knowledge. From now on, no matter if the crime is serious or a misdemeanor, the punishment should be considered to show a bit of forgiveness" (Vietnam Academy of Social Sciences, 1998, p. 273). Thereby, it shows that the thoughts of King Ly Thanh Tong in particular and the thoughts of the Ly-Tran period in general are memorized with humanity, tolerance and love to no matter who or how they are. The two dynasties Ly-Tran successfully kept the country in peace, unity and solidarity as the result of following the spirit of showing mercy to people, treasuring human's lives and showing forgiveness to criminals and those who used to betrayed the country.

# The humanity in the Ly - Tran period is expressed through educating and nurturing people, directing them towards good values

Very deeply influenced by Buddhist philosophy, Tran dynasty's thinkers always direct people to cultivating and perfecting morality, to goodness and noble values in life. During his life, from his mindset to actions, Tran Thai Tong was always interested in training and raising human morality, including interviewing and reciting, chanting, versing combined with meditation and concentration practice, wisdom and repentance, according to "Luc thì sám hối khoa nghi" to reach human perfection, keep your mind pure and let go of all sexual desires to attain liberation. The Five Precepts, including Van the Commandments of Life, the Command of Stealing, the Commandment of Thieving, and the Commandment of Drinking Wine by Tran Thai Tong are a typical example. The entire content of the Five Precepts was written by Tran Thai Tong to advise, educate and perfect human morality. Accordingly, to become a good person should not greed for wealth because "the person who specializes in stealing is young people" (Institute of Literature, 1989, p. 95), should not be overly attached to beauty because smooth hair can easily obscure one's moral character (Xinxing) (Institute of Literature, 1989, p. 98), should not drink alcohol because" the one who is drunk is less virtuous" (Institute of Literature, 1989, p.102), ... in order to lead to wrong things such as" against heaven and earth; contemptuous lies "(Institute of Literature, 1989, p. 102), "the perpetrator lost the

whole morality", "cursed the sky and scolded the earth, criticized the Buddha for increasing" (Literature Institute, 1989, p.102),... Instead are acts of accumulating merit, doing good things such as: giving alms, loving others, worshiping god...

Tran Nhan Tong is considered as another perfect example for the ideology in Tran dynasty. During his whole life, he always cared for his people and the country as well as always wanted to build an independent ideology that is expected to contribute as a spiritual support for Vietnamese people as well as to prevent the cultural dependence in the North. This thought expresses the significance to a moral education, which was the concern of the "greatest humans" and "the greatest geniuses". This is reflected in his poem "Tiễn sứ Bắc Ma Hợp, Kiều Nguyên Lãng":

In the Southern sky, the star is shining bright in both sides
Three - rounds taken, the sky is shining bright
On the other side, thankfulness truly touches
Right here, a simple and little ritual.
Soars the spring wind, fun with horses,
Flags are waving, mind is relaxing
Trung Thong, old edict, please remember
The worries for our country, calm my heart down (Institute of Literature, 1989, p. 479).

Or "To love everyone equally is the God's grace / What a shame for a man to be existing without helping others" (Institute of Literature, 1989, p. 477).

In order to make that wish come true, Tran Nhan Tong expressed his ideas, solutions and methods to educate people and direct people to perfection (cultivate one-self and self -correction), through his propaganda and education of "the ten good" for the people, advise people to follow the commandments:

... Be you and improve yourself for the inner - peace;
To hope or to stop should be aware of
Eliminate bad nature instincts, become a diamond sparkling;
Greediness and selfishness are forbidden to become enlightened.
A pure land is pure, do not doubt the Heaven,
Di Da is the illumination, hard work is a must to reach the Ultimate Bliss.
Improve yourself, train consciousness, karma comes after a minute;
Do not lose yourself, being kind and optimistic, but not to expect reputation to come (Institute of Literature, 1989, p. 505).

Humanity, reflected in the way of educating and nurturing people, in Tran dynasty, we also know the Tue Trung Sergeant. It can be said that throughout his

life, Tue Trung Thuong always treat people with all his kindest heart, directs people to the truth, cultivates morality to attain Buddha's characteristics deep inside through meditation in everyday life.

If Tran Thai Tong supposed that the word "no" arises "expectation", "expectation" creates sentient beings and on the human level, expectation is mindfulness, and therefore, the "self-" is formed. For that reason, the important roles of meditation, education and cultivation of wisdom and morality is to eliminate aspirations, attain non-thoughts and liberation. In Tue-Trung Sergeant's opinion, the word "no" or "non" appears to be transformed, divided into "dualism". It is this "dualism" that has drawn people into discernment, greediness, jealousy and is a barrier for meditation practice. Learning, educating and practicing moral wisdom helps to eliminate not only "bad intentions", but also "bias"; release all delusions, and reach the realm of purity and peace; be sociable, leisurely, freely in life in the spirit of liberation; overcome all the temptation between beauty - no, human goddess, I - them, Buddha - human, right - wrong, worry - peace, consider birthdeath as a life journey living with nature, plants and animals. If Tran Thai Tong supposed that to attain a perfect human being and liberation, a Buddhist practitioner needs to strictly follow the method of gradual meditation and purification according to "Luc thì sám hối khoa nghi", then sergeant Tue Trung has introduced a unique method of learning and cultivation which is being in harmony with everything, and meditate with a mind of freedom, leisure, free from jugdement and letting go depending on the time of being.

Should you feel hungry, eat whatever you want,
Should you are tired, sleep wherever you can!
Should you feel the inspiration, play the flute even without holes,
Should you feel calm, offer an incense!
Should you need a place to rest, the land always welcome
Should you feel thirsty, the river always has water to offer (Institute of Literature, 1989: 280).





And especially the spirit of radical disobedience, no commandments, no suffer:

Commandment and suffer,
Bringing sin but not bliss
To see no sin or no bliss,
Should not obey or suffer (Institute of Literature, 1989, p. 290).

Not only that, he also conceived that *each person's cultivation path* was inseparable from life. Religion is also life and vice versa. In his mindset, this life is the best place to grow spirituality, practice meditation and attain liberation. He clearly expressed this point of view in an poem *Duõng chân*:

No matter how weak your body is, The cranes have no reason to avoid the chickens. To see green stretching along the country, My feet roams freely in every corners (Institute of Literature, 1989, p. 226).

King Tran Nhan Tong used to praise sergeant Tue Trung for his unique method of morality cultivation "The sergeant is friend with the world and the light, but not completely going against people". That is the foundation to continue plant the seeds of perception, and to shed the lights for those who gone to the dogsl. For anyone who came for his advice, he showed them their strength and weaknesses to stay strong and not to fall in the trap of sin" (Institute of Literature, 1989, p.545).

## Conclusion

The humanity in the ideology during Ly - Tran period is not a random phenomenon but it is the product of the crystallization from the social basis and certain theoretical premises. It is not only a key to solve many important social problems, contribute to the independence and the power of Dai Viet, demonstrate the talent and virtue of the rulers. Moreover, it is one of the biggest lessons from history for the nation to handle the issues for the purpose of a peaceful country and a close-knit community. The humanity in the Ly - Tran period, therefore, still has significant historical and practical during the process of constructing our Vietnam



UnilaSalle

today; especially has great impacts on the aspect of love and respect, appreciation of the role of human and citizens in social development and cultivation of personal morality in the society.

### REFERENCES

Ha, V. T., Pham, T. T. (2003). The 13th century resistance war against Nguyen - Mong invaders. Hanoi: People's Army.

Institute of History. (1978). Vietnam far away from Ly - Tran. Hanoi: Social Science

Literature Institute (1989) Poetry of Ly - Tran, volume 2, upper book. Hanoi: Social Science Publishing House.

Nguyen, D. T. (editor, 1996). History of Vietnamese Education before the August 1945 Revolution. Hanoi: Education.

Nguyen, L. (2000). Vietnam's Buddhist history. Hanoi: Literature.

Phan, H. C. (2006). Lich dynasty constitutional chapter, episode 1, 2. Hanoi: Education.

Tam is awake. (1995). Vietnam Buddhist Research Institute.

Tran, V. G. (1996). The development of Vietnamese thought from the nineteenth century to the August Revolution (3 volumes). Hanoi: National Politics.

Truong, H. Q., Dinh, X. L., Le, M. H. (2002). Outline of Vietnamese History. Hanoi: Education.

Tran, T. T. (1974). Khoa hu luc. Hanoi: Social Science

Truong, V. C., Doan, C. (2008). Vietnamese Thought in the Ly - Tran period. Hanoi: National Politics.

Truong, V. C. (1998). Philosophical thought of the Truc Lam Zen sect of Trandynasty. Hanoi: National Politics.

Vietnam Academy of Social Sciences. (1998). *Complete Annals of Dai Viet*, Vol.2, Hanoi: Social Sciences.